The American Army Railroad Cut-off in France, *by R* *mlin, jr.*

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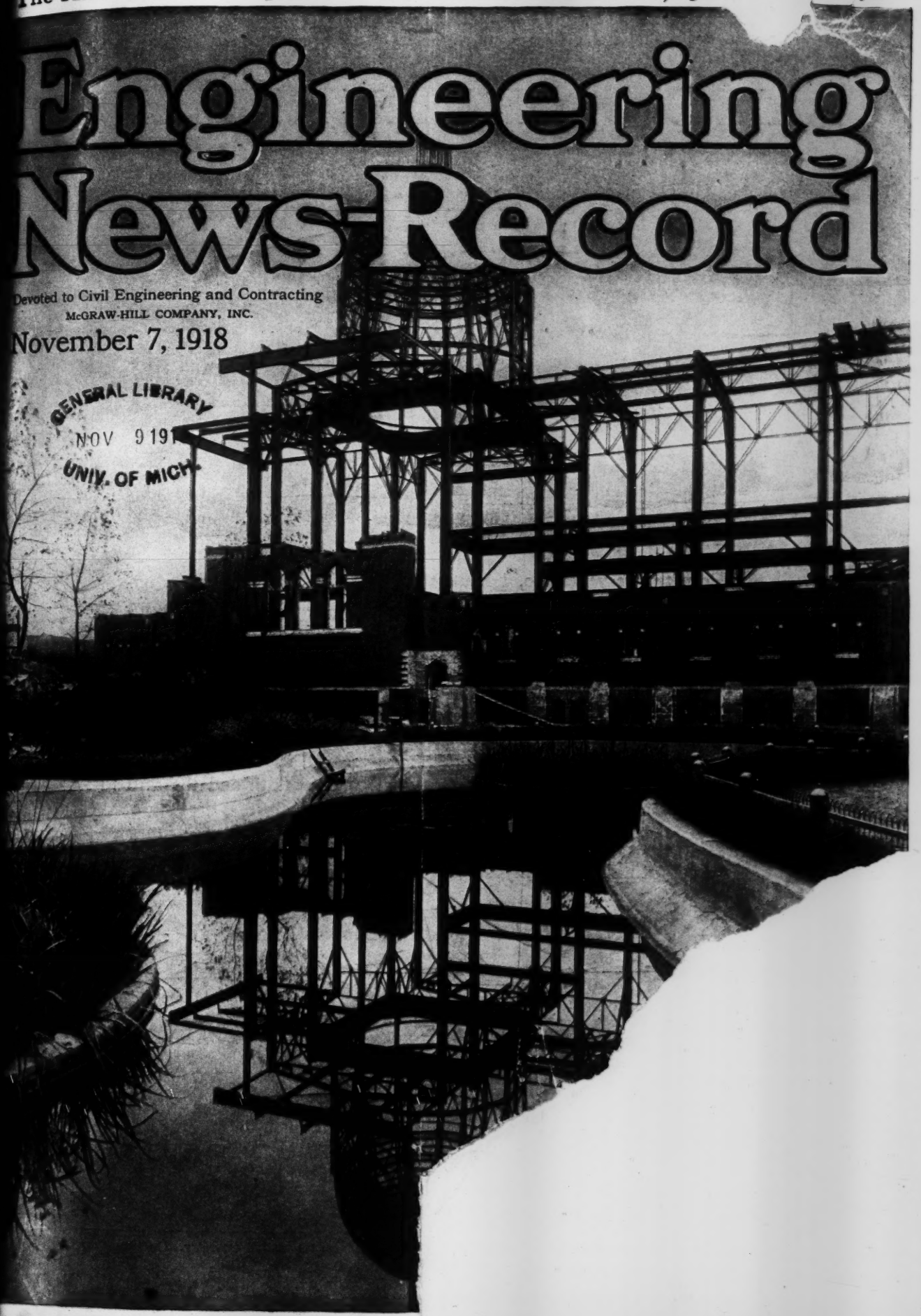

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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN, Editor — CHARLES WHITING BAKER, Consulting Editor

Volume 81 — NEW YORK, THURSDAY, NOVEMBER 7, 1918 — Number 19

Adequate Forest Supervision Necessary

FOREST fires are so common that ordinarily they cause little comment. When, however, a disaster occurs of the magnitude of that in Minnesota, reported in *Engineering News-Record* of Oct. 31, p. 822, and further described of p. 841 of this issue, entailing large loss in both life and property, the whole country is aroused and adequate measures to prevent a repetition are proposed. Too often the subject is soon forgotten, and legislatures continue to practice false economy. Such procedure has now cost the State of Minnesota the loss of a thousand lives and untold property damage. In our present needs losses of this character, to say nothing of the loss of life, are particularly deplorable, and Minnesota's experience should serve notice upon legislatures that provision must be made for adequate supervision of forest areas.

Let the Public Be Heard On Reconstruction Bills

RADICAL differences between the two reconstruction bills now before the Senate concern the country's interests deeply. Shall the people be heard on the choice of method? Shall men from business and private life share in the all-important work of preparing for the nation's restoration to peace conditions? Hearings on the bills are essential to bring these questions to an issue. All who take an interest in the problems facing us should write to members of the House and the Senate, urging that public hearings be arranged before either of the bills is acted on in committee.

Can the Company's Officers Escape the Responsibility?

WHENEVER a big railroad wreck, fire or similar disaster causes great loss of life, especially within the confines of a large city, it is the fashion for the authorities to start several investigations, vowing the while that dire punishment will be visited upon the men higher up who were responsible for the conditions that made the disaster possible. Verbal fireworks fill the newspapers for a time, but in the end the worst that befalls the men higher up is a few sleepless nights. The chances for immunity in the case of the recent Brooklyn Rapid Transit wreck seem less than usual. A strike was on, and it was a substitute motorman who hurled the train against the concrete wall. Now, in spite of public clamor to the contrary, it is inevitable that operation will be less safe during a strike than in normal times; if the company is not in all cases to capitulate without a fight, and trains are to be run at all, they must be run by men less qualified than the regular crews. Where the line should be drawn has never been determined. But the cause of this particular strike was the failure of the company to abide by the ruling of the War Labor Board and reinstate 29 discharged employees. Instead, the company had referred the question to an association of the employees, which, however, had all the earmarks of being controlled by the company. For this reason the officers of the company are likely to have much trouble to explain away their responsibility for the disaster.

A Worthy Memorial to an Engineer

IT IS rare nowadays for any recognition to be given to the engineer responsible for a piece of creative work. We have come to class the design and building of great dams and huge machines and long-span bridges with the routine operations of a factory. It is especially worth while to record, therefore, an instance of a contrary sort. In the Yosemite Valley, in California, the Government has recently completed a hydro-electric plant, trifling in size, as such plants go nowadays, but of especial interest in view of its location in this National Park. On Sept. 7 this plant was dedicated, with appropriate ceremonies, as a monument to the memory of the late Henry Floy, consulting electrical engineer of New York City, who made the preliminary studies which resulted in the Congressional appropriation for its construction. In an address at the ceremony of dedication, Stephen T. Mather, Director of the National Park Service, paid a tribute to the patriotic spirit of Mr. Floy, who prepared the preliminary studies for the plant as a matter of public service, for nominal compensataion, and made an argument in its favor before the House Appropriations Committee. His death occurred shortly afterward, and the final design and supervision of the construction were carried out by Galloway & Markwart of San Francisco.

Joint Discussion of a National Problem

MORE than narrow technical interest appears in a joint meeting of the civil and mechanical engineering societies which is to be held within two weeks for the discussion of steel conservation. It is a piece of real coöperation for the societies to come together in a unified technical discussion. Clearly the centripetal forces of the times are making themselves manifest. Evidences multiply that engineers are drifting toward a common center. If this process of aggregation continues, it is inevitable that in time a definite

group will crystallize out, an engineering profession. In the present instance, more than coöperation is to be seen, however. The joint meeting will discuss a subject that is vital to the nation's industrial life—vital, certainly, in the extreme conditions of the moment, and in all probability also during the times of change lying ahead of us. Service to the community is represented in such a discussion, if it be rightly conducted.

Maximum Capacity of Motor Trucks

WHAT limit shall be set to the load capacity of motor trucks to be used upon the public highways? This question must be settled in the near future, if healthy progress is not to be retarded. While highways previously considered satisfactory are breaking down under the strain of heavy loading, and highway engineers are looking forward with apprehension to their behavior during the trying condition of the coming winter, and while there are mutterings here and there among legislators indicating action to regulate the use of trucks, this problem, still unsolved, becomes more urgent every day. As was pointed out in our issue of Aug. 8, p. 253, the only satisfactory method of determining what maximum load should be is discussion and concerted action of those most interested in its solution. With the winter legislative sessions pending, there is danger that legislative will take ill-advised action, before those who are qualified to settle this matter have had time to establish the proper working load.

A Way To Preserve Equipment Values

CONTRACTORS are notoriously wasteful of machinery value. Abuse in operation, neglect of prompt repairs, and careless storage of idle units, make up each year a loss in plant value which amounts to a heavy tax on public works. Needless deterioration of construction plant due to careless winter storage is perhaps the largest item in this aggregate. It exists because contractors widely have not divorced themselves from the old habit of considering the job as the life of the equipment.

In the days past, when most construction operations were performed by hand, men were hired for the job and let go when the job was finished. Then also the few and simple machines used were bought for the individual job and charged into the cost of that job. The job period thus came to be considered the period of service of equipment as well as of men. Each succeeding year's contracts meant a new working organization and in large measure a new outfit of machines and tools. Little inducement existed under such conditions to preserve equipment. Why operate and maintain a machine in a manner to extend its life? It would be sure to last through the job, and then its usefulness would be ended. Let the tail go with the hide!

Always a mistake, war has made this policy a vital error. Equipment prices are high. New production is limited, as metals are being commandeered for war. War construction is consuming the permitted output to the exclusion from the market of the ordinary purchaser. This winter the need is greatest for laying up equipment in such manner that deterioration will be reduced to a minimum.

Timely Words on Shipping

QUICK realization of the influence which its actions reported last week would exert on our high-pressure shipbuilding is evident in the Shipping Board's statements printed in the news columns of this issue (page 867. What Chairman Hurley and Mr. Schwab say to the yard workers is timely indeed. It brings much-needed reassurance.

But the statements go beyond this. They lay down a shipping policy for the country—or the first clause of that policy. We are to build a fleet of three thousand merchant ships. This declaration is vital to all the great development lying before us and dependent on the growth of a world commerce.

No men can speak today with more authority or with a stronger voice of conviction on the shipbuilding question than can Mr. Hurley and Mr. Schwab. They have studied intimately our maritime needs and our ability to meet those needs. They have wrestled with every one of the problems involved, and have dealt with each man in the long line from shipwright to merchant. Their plans are based on knowledge and enterprise. Support for these plans will not be wanting when the question comes to an issue.

New Views on Licensing Prevail

ON a number of occasions we have thought that the question of licensing engineers has been finally disposed of. But it will not down.

Recently we have heard eminent and conservative engineers, formerly opposed to licensing, declare themselves in favor of it. They have come to believe that the resulting legal status will help in the development of a professional consciousness and also in impressing the importance of the profession upon the public.

Engineering News and *Engineering Record* both opposed licensing on the several occasions when the question was at issue in New York State and in Pennsylvania. The purpose of those promoting the bills was to prevent the incompetent from engaging in the practice of engineering. Any feasible measure, however, would fail so surely in accomplishing that object that it was futile on that ground to pass it. Therefore we urged, and in that were giving voice to the views of thinking members of the profession throughout the country, that there be, instead, strict examination of the plans and construction of engineering work, holding that such examination and not licensing would attain the desired end.

Now the argument has changed, and the drift toward licensing is strong. The arguments, in our judgment, are valid. The profession may not be made measureably better by licensing, but it will have a definite status before the law and in the mind of the public because of the statutory recognition. The public will feel that the engineer occupies a more important place, while discipline by a board of examiners would secure wide publicity and have a favorable reaction. Moreover, with a legally constituted and protected body, it is conceivable that the legislature would call upon it for advice on legislation affecting engineering work, just as the county medical societies—having a legal status, it is

true, only because all their members are licensed—are consulted by boards of health. And the scheme works also the other way; the medical societies do not hesitate to urge new or revised regulations on the health boards.

In addition to this external influence, there would be manifest advantages from the standpoint of professional organization. All engineers would be licensed merely as engineers, and there would thus be a tendency to break down the regrettable lines between the different specialties. The law would also tend to force the organization of the profession along state lines and by creating solidarity on local issues build up that strong influence which our past national organizations through technical societies have only begun to develop. In other words, the internal effect of licensing would be in the very direction that is now indicated for professional reorganization.

Licensing with those arguments in his favor—particularly in these days—is certain to make rapid headway.

The Railroad and the Banking Type of Mind

A FRIENDLY critic has protested against our citation of the railroads as an evidence of the failure of the banking type of mind in running the industries of the country (see editorial on the Development Committee of the American Society of Civil Engineers, in *Engineering News-Record* of Oct. 10, 1918, p. 651). He pointed out that our railroad system has led the world in extent, in development of the country, in efficiency and in low freight rates. We do not believe that many, if any other, readers of the *Engineering News-Record* have failed similarly to catch the significance of our remark about the railroads. Had we been referring to what might be called technical engineering excellence, our word would have been different. But we were discussing the railroads as a whole, as part of the industrial scheme, and as such having an economic and a social bearing. Looked at from that standpoint, we do not hesitate to repeat the original statement.

Here was, and is, an agency with daily influence on the life of every member of the community, performing a service essential to the nation's life. Yet it has few friends among the people at large; more now than formerly, however, due to the number of those whose pity has been excited at the railroads' plight. The first of the railroads' plagues was the type of management—manipulation, it would better be called—which regarded the properties not as carriers but as media for stock-jobbing operations. Consolidations, with the addition of water, and reconsolidations, with still more water, were the order of the day; while those operating the properties danced riotously over their territories waving insolently the flag of "The Public Be Damned." Rebates, car-withholding tyrannies, all manner of schemes were worked to aid the favored few, while the purchasing methods honeycombed the organization with rottenness. Then came the day for the people to have their say, and one national and 48 state commissions began to bedevil the carriers. What the stock jobbers and the grafters had failed to do, the people in their vengeance helped to complete. The public at large, which under intelligent management of the properties would have been the railroads' best friend, had been alienated. As a result we have had the drift into bankruptcy which has been railroad history during the past decade. Instances need not be cited. Each one can supply them from his own neighborhood. Probably the mention of the New Haven will furnish sufficient nausea to carry the right impression.

And that *débacle* we attribute to the banking type of mind, that type of mind that places personal profit ahead of all other considerations. The engineering type of mind, we hold, would have analyzed the purpose of the railroads—would have seen that service to the public at large, and not to any private interest, was the prime object, would have erected that as the railroads' ideal and builded a machine for its attainment.

To our minds, the situation is as an open book. If the railroad plight is not a failure, we do not know the meaning of the term.

Prepare Now for Winter Snow Difficulties

WHAT are city, highway and railway authorities doing to meet approaching problems of snow removal? Last winter the conditions were specially severe. Have the experiences and lessons been turned to account, or shall we be unprepared when this annual problem again confronts us?

Formerly the main reliance has been placed on shovel gangs and teams or trucks, but in severe storm and cold the efficiency of this method is low. Labor shortage was a difficulty last winter, and will be a greater difficulty next winter. So serious were the conditions of snowfall and labor in Chicago that the city had to urge householders to clear not only the sidewalks but also the streets opposite their property in order to permit the passage of fire apparatus as well as of wagons for distributing supplies. Difficulties in delivering coal and food were a menace to public welfare in several cities.

Some mechanical devices for clearing snow were devised and tried. Have these been perfected and put in readiness? The importance of motor truck traffic led some highway engineers and superintendents to keep the roads open and to break through heavy drifts immediately after the storms. The enormous development of this traffic for military and commercial purposes makes such work a still more pressing necessity during the coming winter. Railways were troubled specially by complete or partial blocking of terminals, with the strange results that at some large passenger terminals neither main line nor suburban traffic could be operated for 24 hours or more. The weakness of the shovel-gang system in such cases was very evident.

Preparation for the emergency may include the study of conditions, appropriation of funds, organization of forces, supply of tools and equipment, agreement with farmers along the roads, investigations and construction of special apparatus, and consideration of means of disposal.

It may be asked again: What are city, highway and railway authorities doing or planning to meet the snow removal problems of the coming winter?

TEMPORARY TRESTLE CARRIES NEW AMERICAN-BUILT RAILROAD CUTOFF OVER HIGHWAY

American-Built Railroad Cutoff Will Relieve Traffic Congestion in France

On New Double-Track Line for Expeditionary Forces, 5¾ Miles Long, Construction Plant Is Speeding Up Work—Big Embankment the Chief Feature—Bridge Half a Mile Long Spans Important River

By Robert K. Tomlin, Jr.
Photographs by Engineering News-Record

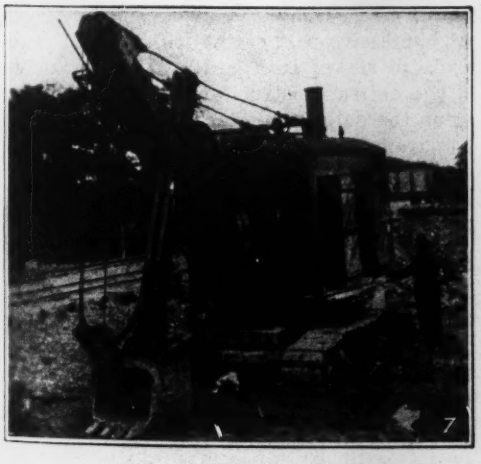
OF SECONDARY importance is the fact that a distance of five miles will be saved by the new standard-gage double-track railroad cutoff line which engineers of the American Expeditionary Forces are building in central France. Its chief value will be realized in the by-passing of traffic around a certain city where existing French railroad lines converge, and where the yards at the present time are choked with freight cars, on American Army service, going to or returning from the advance section—to say nothing of the freight and passenger trains which must be run for civil, rather than military, purposes. The new line, which will probably be completed and in operation by the time these notes appear in print, offers a through route for eastbound and westbound traffic passing through the intermediate section of the Army, and cuts out a loop around which all trains must now pass, and which, under conditions of freight haulage which is increasing in volume every week, has been the cause of serious congestion and delay. This job involves the building of a line about 5¾ miles long, requiring a large yardage of embankment and the spanning of a river by a timber and steel bridge 2200 ft. in length.

Judged by many of the projects upon which American engineers are engaged in France, this railroad cutoff is being built with the aid of a large amount of construction plant almost entirely American-made. At least, that was the situation when I tramped over the line late in July, although when the job was in its early stages, hand-labor methods were much more in evidence, I was told. Fills amounting to a total of 414,000 cu.yd., cuts aggregating 160,000 cu.yd., the 2200-ft. bridge referred to, and several smaller crossings of canals and highways, are the main features of the work, which is being carried out under the direction of the section engineer of the Intermediate Section East, A.E.F., a lieutenant-colonel of engineers of wide railroad experience. It may be well to explain that in the Army nomenclature the title "section engineer" is one which carries with it much greater responsibilities than are associated with the work of a "section engineer" of an American railroad. In the present case, the engineer of the intermediate section is in charge not only of the railroad cutoff, but of many other projects, including two 20,000-bed hospitals, veritable cities in themselves.

Starting at the west end of the cutoff, where the new line connects with an existing double-track line of an important French railroad, it was necessary to build an overhead crossing to carry one track of the new route across the old tracks, and avoid the conflicting operating movements of a level junction of two double-track railroads. The bridge over the French track (see cut above) is made with 50-ft. lattice steel girders obtained from England. The abutments consist of clusters of timber piles. The clear span of the bridge is 36 feet.

All of the work at the extreme west end of the cutoff

FIG. 1. TRENCHES FORMED BY CHINESE LABORERS TAKING OUT FILL FOR EMBANKMENT



American-Made Equipment at Work on Grading of French Cutoff

Fig. 2—Steam shovel at work on cut. Fig. 3—Excavated material handled by side-dump cars. Fig. 4—Caterpillar tractor hauls elevating grader for embankment work. Fig. 5—Character of material in main cut—Note in foreground air drill and reflector for illumination at night—In background steam-shovel boom. Fig. 6—Shovel with 2½-yard dipper works three shifts, aided by light from portable reflectors. Fig. 7—One of the smaller steam shovels is mounted on caterpillar treads. Fig. 8—American-built side-dump cars are fitted with French buffers

FIG. 9. WHERE THE LINE CROSSES A FRENCH CANAL

was fill, and a total of 113,000 cu.yd. was placed there, principally by hand-labor methods. The maximum height of this fill is about 30 ft. A force of Chinese laborers, the so-called Annamites, was employed in forming the base of this embankment. They worked with pick, shovel and wheelbarrow, borrowing earth alongside the right-of-way by a system of long, narrow, trench-like borrowpits, as shown in Fig. 1.

The material is a clay, overlying rock at a slight depth, which accounts for the large number and the shallowness of the trenches worked by the Chinese. In fact, coming upon this borrow work without knowing the reason for it, one might almost mistake it for a scheme of fortifications rather than excavation for a railway embankment.

At the time the fill from these borrow trenches was made no timber was available for a trestle from which to dump the excavated earth. The construction scheme followed was, first, to place a broad base layer of fill, and upon it build up a narrow earth core carrying a single line of track. On this track loaded cars were run out and dumped to build out the embankment to its proper width. As the work proceeded the construction track was jacked up and the core raised until the top reached grade. On the later stages of this fill American negro labor battalions were used.

For double track, the roadbed widths are 34 ft. in cuts and 30 ft. in fills. The single-track sections are 22 ft. wide for cuts and 18 ft. for fills. The rail is American-made, 80 lb. per yard. The maximum grade is 0.7% and the curvature 5 degrees.

At a point near the middle of the first fill there is a highway which had to be kept open. As the work progressed more supplies and plant began to arrive, and when some timber posts and stringers were delivered they were employed to form the trestle crossing shown in the headpiece of this article.

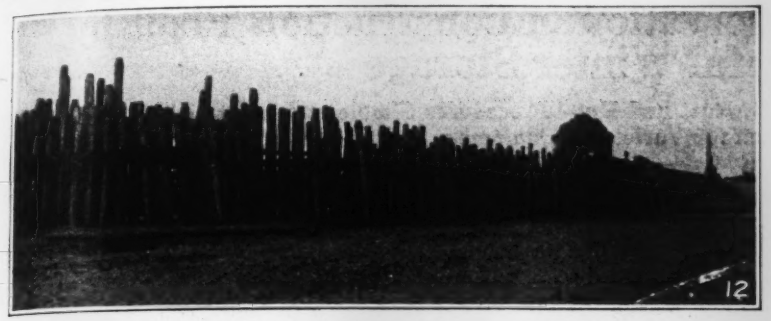
One of the first cuts on the line is situated east of the crossing of the French railroad. Here one of the four steam shovels used on the job is operating. A good idea of the character of the digging is shown in Fig. 2. Much of the excavation is now handled by hand-dump cars, as shown in Fig. 3; there were about 60 of these cars on the job at the time of my visit, in addition to several 35-ton American-made and two 65-ton Belgian locomotives. In the early days boiler water for both steam shovels and locomotives had to be hauled to the job over roads in tanks from a canal, but now a pipe line and pump have been installed. One of the smaller steam shovels, which has a ⅜-yd. dipper, is mounted on caterpillar treads, as shown in Fig. 7.

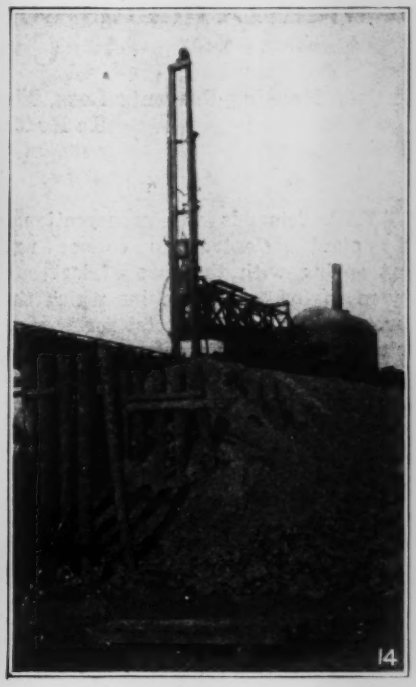
The largest continuous cut is about half a mile long and involves about 85,000 cu.yd. Here the material is largely limestone rock, requiring a considerable amount of drilling and shooting. For the upper part of this material, which is blocky, hand drilling is generally resorted to, as a machine drill often sticks. Lower in the cut, however, the blast holes were put down with light tripod drills (Fig. 5) running on air supplied by portable, gasoline-driven compressors, each compressor having a capacity for operating two drills. The material was taken out and loaded into cars by a 70-ton shovel with a 2½-yd. dipper, as shown in Fig. 6. On this cut the steam shovel has been worked continuously in three shifts; during the night operations illumination is supplied by lights (Figs. 5 and 6) set up at a number of points where excavation and car loading are in progress. The rock excavation on the entire cutoff job has required about 40 tons of explosives.

Following the line eastward one reaches the next important feature, a crossing over a French canal, effected by 50-ft. latticed girders and timber trestle bents, as shown in Fig. 9.

The most impressive part of the job, however, is the 190,000-cu.yd. fill shown in Fig. 10. This is, in fact, the key to the entire construction, for its completion will determine the date upon which the new cutoff can be opened to traffic. This fill is being made with material from the cuts west of it and also from large

FIGS. 10 AND 11. FILL WHICH, WHEN COMPLETED, WILL CONTAIN 190,000 CUBIC YARDS, AND TRESTLE FROM WHICH SIDE-DUMP CARS DISCHARGE TO FORM IT





FIGS. 12 AND 13. SUBSTRUCTURE FOR HALF-MILE RIVER-BRIDGE—1700 PILES HAVE BEEN DRIVEN. FIG. 14—STEAM-HAMMER PILEDRIVER ON END OF BRIDGE IS MOUNTED ON STANDARD-GAGE FLAT-CAR

borrow areas which are being worked with 300 horses and slip-and-wheel scrapers, in addition to elevating graders hauled by caterpillar tractors. This latter equipment is shown in Fig. 4.

At this writing, the principal effort of the construction forces is being concentrated on this big fill. The construction scheme is so clearly shown in Figs. 10 and 11 that no description is needed. It should be noted, however, that all of the timber for the long trestle from which cars dump was furnished by American forestry regiments operating here in France.

This fill is in the valley close to the river which is crossed further on by the new cutoff; to guard against a washout during flood periods the upstream surface of the embankment is faced off with rock, while the core is the earth obtained from the borrowpits nearby. The photo indicates very clearly the two classes of material entering into the embankment.

Before the new double-track cutoff joins the main line tracks of a French railroad at its eastern end it crosses a large river. The type of construction adopted was a trestle bridge consisting of 89 timber spans of 14 ft. each, and 16 steel spans of 50 ft. each, resulting in a total length of almost ½ mile (Fig. 12). Piles for this structure (Fig. 13), most of them 50 ft. or more in length, were furnished by the forestry forces of the American Expeditionary Forces.

The driving was done by two steam-hammer rigs, operating from either side of the river. The American-made piledriver shown in Fig. 14 has leads carried by a steel-truss cantilever extension arm, the whole rig being mounted upon a standard-gage flat-car.

In the entire bridge there are about 1700 piles, the main clusters forming the pier foundations containing 43, and the trestle bents 10 each. The work of pile-driving for the bridge substructure proceeded in two shifts per day. Throughout this work there has been little rain and the river has shrunk to only a fraction of its normal width. Fig. 12 shows the river bottom uncovered and allowing the use of an ordinary land pile-driver of the steam-hammer type on the western end of the bridge.

Eastward from the bridge the last section of the cut-off is a 40,000-yd. fill. Of this amount about 15,000 yd. was placed by negro battalions with wheel-barrows, while the remainder was delivered by cars that ran on 60-cm. track and were loaded at a borrowpit by a steam shovel.

One detail of the dump cars used for hauling material from the heavier cuts on the line is shown in Fig. 8. It will be noted that this American-made equipment, which is of standard gage, has been fitted with the type of buffers which are universally employed on the rolling stock of all French railroads.

In the delivery of piles to the job motor trucks played an important part. About 400 of the 50-ft. piles were transported a distance of 70 miles by American-made trucks from which the bodies had been removed and to which trailers were attached to support the rear ends of the long lengths of timber.

The new railroad cutoff line in the Intermediate Section East of the American Expeditionary Forces is notable in that it represents a very marked transition from the hand-labor methods which have, from the beginning, been so prevalent here in France. At very few places over here can one see collected on a single project so comparatively large an assortment of American construction plant as is in operation at this site.

War Demands Conservation of Construction Plant by Careful Winter Storage

Proper Housing Prevents Loss, Theft, Rust and Rot—Procedures Simple and Inexpensive—Measures To Be Taken for Variety of Equipment Reviewed

By C. S. Hill
Associate Editor Engineering News-Record

WAR demands the conservation of construction plant. Contractors cannot replace equipment next spring with the ease of last spring. They will pay more for every machine which they buy. As the Government's call for metal for war work becomes insistent, and as war construction here and abroad commandeers a still greater volume of the permitted factory output, the scarcity and the price of all plant employed by contractors will increase. Second-hand equipment, already scarce and costing more than did new equipment

TIME-HONORED PRACTICE RIGIDLY FOLLOWED IN STORING DUMP CARS

a year ago, will fetch even higher prices and be more difficult to obtain six months hence. Existing equipment must be conserved!

For years loss, theft, rust and rot of improperly stored equipment have exacted every winter an enormous toll of plant value. Examine the views reproduced herewith. They were taken last winter. They can be duplicated any winter anywhere in the northern United States. Carelessness in conserving expensive equipment could not easily be carried farther than is depicted by some of these illustrations. All contractors do not abuse their equipment in this manner. No contractor need do it. Preparing and housing plant for winter storage is not a difficult task. The processes are all simple. It takes less time to prepare a machine to endure the cold and damp of winter than it does to repair, when spring work begins, the damage of frost and moisture to a machine which has been left unprotected.

Put equipment in good repair as it is stored. Do not store a car with loose hinges and a warped floor; tighten the hinges and level up the floor. If the wood draft sill of a steam shovel has been partly burned out, replace it. Replace worn scraper bits and runners and dulled dipper teeth. Sharpen and rehandle tools which need these attentions. Put the whole machine structurally in shape for immediate use—then *paint* the machine. Paint is a gilt-edge investment.

Some wise contractors keep blacksmiths at work during the winter sharpening tools and doing other repair work. A handy mechanic, one who can turn his hand to a variety of tasks, will earn his pay twice over doing odd jobs of repair work on machinery laid up for the season.

One picture shows a locomotive crane laid up for the winter. Its power and size and endurance appear to deceive many contractors into the belief that heavy equipment, like steam shovels, dragline excavators and locomotive crane excavators, will safely resist rust and rot and frost when smaller machines will not. This is a great error. No type of equipment should be more carefully laid up. These big machines represent a large investment; they must ordinarily be laid up out of doors.

Select for storage a place which permits the free run-off of rain and melting snow. Select a situation also which the wind will keep swept clear of snowdrifts. It costs something to run a steam shovel out of its pocket in the pit onto clear high ground, but it costs more to let it stand under winter drifts and in a spring pond.

Lay up the boiler while it is warm. With the boiler almost full of water, pour in three to five gallons of heavy oil. The oil will float to the top. Then drain the boiler. As the water recedes a coating of oil will be left on the sheets and tubes. This procedure will take care of the inside of the boiler. To protect the outside, thoroughly clean the sheets and the firebox, removing all corrosion and scale. Then paint the firebox and sheets; the paint will burn off when the boiler is fired up in the spring, but during the intervening months it will have protected the steel from corrosion. Cover the top of the stack; this is a simple precaution which is often neglected. Finally, open all flanges in

BOARDS ACROSS CAB OPENINGS KEEP THE COWS OUT OF DINKY LOCOMOTIVE

the steam piping so as to insure thorough drainage; the flange packing will be lost, but almost invariably new packing must be put in every spring anyway, so the loss is not worth considering.

Instead of painting sheets and firebox some contractors swab them with oil. They also clean and oil the

CABLEWAY HOIST SNUGLY HOUSED AND CARRIAGE AND FALL MADE FAST FOR WINTER

tubes. Rust is the enemy that has to be guarded against; it is as insidious as the Hun, and no chances can be taken with safety.

Repaint all the painted parts of the engine. Cover all the bright parts with grease. Remove the packing from the piston and valve stems and paint the rods and stems with heavy oil and white lead. Unless so protected, rods and stems will pit; these pits do not look serious but they roughen the rods enough to cut the packing rapidly. It is much cheaper to paint the rods in the autumn and clean them in the spring than it is to renew the packing at frequent intervals during the working season. Oil the cylinder and the valve seats thoroughly. Do this even if it is necessary to remove the steam-chest cover and destroy the gaskets. Some makers of steam shovel engines place in the steam-chest covers plugs through which the parts can be flooded with oil.

If the machine is motor-operated and the cabin has been well closed in, it is sufficient ordinarily to cover the motor closely with heavy, tarred canvas. The best thing, however, to do with any motor on any machine which has to be stored out of doors is to remove it and store it in a tight, dry room. Similarly, cover with canvas the boom engine after preparing it otherwise as described for the main engine; or this engine may be tightly boxed in with boards after the boom has been lowered.

Gears and cables should be slushed with grease and all grease cups should be filled and then turned down so as to cover and protect the bearings. Cable should be unrove and wound on the drum.

Unship the dipper and handle and lay it on blocking so that it clears the ground. Paint the dipper handle and slush the rack with grease. Lower the boom onto a horse or blocking, paint it and cover in the boom engine as previously described. Close the cabin and board up the front end. Paint the cabin and frame.

All small tools, picks, chains, hose, etc., should be cleaned and locked in a box inside the cabin. It is not a bad plan to remove the journal brasses and store them in the same manner. It is not only rust and rot which have to be guarded against, but also theft.

Small machines like concrete mixers trench excavators, air compressors, pumps and hoists should invariably be housed in when laid up for the winter. This does not mean necessarily that the machine must be put into a storehouse, but that it should be inclosed by some form of weatherproof housing or covering. One contractor in Chicago who owns three trench excavators has a concrete house, with a concrete floor, in which he locks his machines. Another runs his machine up on timbers and boards it in tightly, all except the ladder, which is lowered and left sticking out. A third has a large tarpaulin with which he covers the whole machine. These practices exemplify the three possible methods of housing, in the order of their excellence. The least excellent is the tarpaulin cover; it should not be employed if one of the other methods is practicable.

Trench excavators are small machines only in a comparative sense, and they are expensive machines and so warrant care in preparing them for storage. At the end of the season clean and paint all parts of the machine which were originally painted. Cover all the bright parts heavily with grease. Remove drive and conveyor belts, roll them up, tie and store in a dry place. Also remove all engine parts, such as carbureter and magneto or injectors, pump, steam gage and governor,

MIXER ROOFED BY THE SKY AND WRAPPED IN SNOW, LIKE THE FLOWERS, AWAITS SPRING

grease them thoroughly and store them in a box. Oil the cylinders and valves and grease the gears, racks, etc. Lower the ladder and rest it on a horse on the ground. This takes the strain off the hoisting machanism and helps to preserve it. Finally, inclose the machine in a weather-tight housing.

Hoists should be housed. Clean the grease from all

TARPAULINS KEEP THE SNOW OFF PUMPS AS LONG AS THE WIND DOESN'T BLOW

painted parts and repaint; slush the shafting, winch heads and all bright parts with heavy oil; drain the cylinders and leave the cylinder cocks open. Empty the boilers; it is well to run a light fire for a few minutes to dry the head and tubes. Swab the inside of tubes with a heavy oil. Finally, cover the entire machine with a tarpaulin. Electric hoists should receive the same general preparation as steam hoists. The motor should be either removed and stored in a well protected place, which is really the only proper way, or, if this cannot be done, it should be covered with heavy tarred canvas.

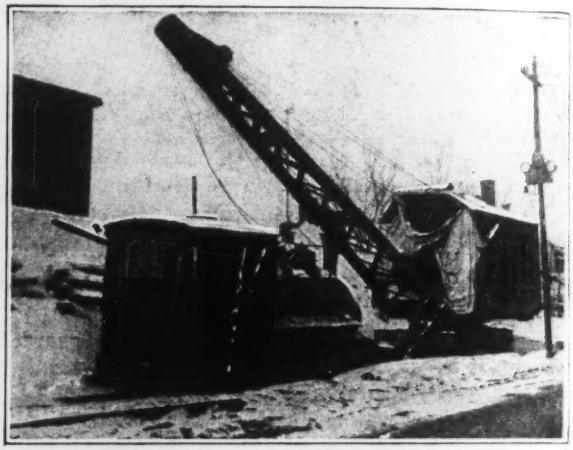
When compressors are not in service or are placed in storage the complete drainage of all the water and steam spaces should not be forgotten; otherwise, cracked cylinders and heads and split pipes and tubes will result from freezing. All lubricating oil should be drained off. All lubricators and other small brass fittings should be removed and boxed to prevent breakage or loss by theft. The compressors should be covered with tarpaulin or waterproof paper to keep out dust and water. If they are to be out of service for any length of time, the steam, exhaust and water piping should be disconnected to avoid any possible chance for water to leak in. If the compressors are belt driven, the belts should be removed and stored in a dry place.

Drills are about the most roughly handled expensive tool which the contractor uses. Packing for shipment and preparation for storage of drills are woefully defective.

When packing them for shipment care should be taken to see that the feed piston of stoping drills or the main piston of reciprocating drills are securely fastened so that they cannot run out of the drills. It is almost impossible to bend these, when they are run into the drill their full length, but if they are fully extended they are very liable to become bent in handling and shipment. All finished parts should be slushed with some compound not easily washed off with water. Do not use excelsior for packing the parts, as it is difficult to clean off. All holes extending into the interior mechanism should be plugged with wood so that grit and dirt will not be introduced into the drill. When putting steam reciprocating drills in storage particular care should be taken to blow them out thoroughly with compressed air, or if this is not available remove the packing in the lower head. If this is not done the piston rod will become badly rusted and pitted where the wet packing remains against it for a long time.

Scrapers and graders are a class of tool which it is ordinarily assumed needs no preparation for winter. They both require and repay attention. Clean and paint drag and Fresno scrapers. Wheel scrapers should be freshly greased and nuts and bolts tightened up. Paint the whole machine. If the whole machine is not painted, at least cover the bottom of the pan with some rust preventive; ordinary red lead and tallow make a good mixture. Take off the tongues; preferably stack them on end; if stored horizontally place a support at the middle, or else the timber will sag and take a permanent set. Clean elevating graders thoroughly and paint them. Oil all bearings. Remove rubber belts and store in a clean, dry shelter. Take off and box the brass oil cups to prevent theft.

It is sinful to lay up a locomotive out of doors, but conditions frequently make it necessary to do so. Then, above all things select a place which will be as free as possible from snow and water. Wash out the engine



CARELESSLY ARRANGED DRAPERY CONCEALS CRANE MECHANISM FROM PASSING GLANCES

boiler, and then refill it and pour in about 5 gal. of black oil. Draw off the water slowly. Oil the washout plugs before they are replaced and leave the blow-off valves open. Clean the flues, dump the grate, clean out the ash box and paint with heavy black oil both flue sheets and firebox. Clean the smoke box, especially around the bottom of the front flue sheet.

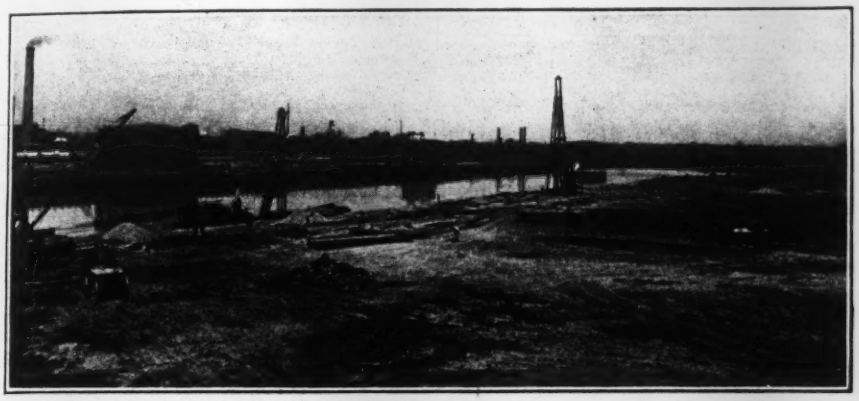
Cover the stack with a board and bolt the board down with a rod running down through the stack to a cleat. Drain the tank and take the drain cock out. Remove all fittings and box them and store the box safely. Take off the steam-chest covers and oil the valves. Remove the cylinder heads and shove them as far ahead as they will go and then oil the cylinder. If the main rods are left on, wire them tight to the yoke so that the main pin will clear the back end of the rod. If the rods are taken off, lay them on the run boards, cleat them down and cover them with a board. Paint all the bright parts thickly with white lead. Board up the cab, including the windows.

Dump cars are made to endure a rough life, but they are not properly stored by rolling them down the embankment, as one of the pictures shows.

New Lake Shipyard Has Side-Launching Ways Under Cover

Ships Built at Ferguson Yard Fabricated in Company's Shop Two Miles Away—Berths Covered with Cantilever Roof and Served by Semi-Gantry Crane

ALL assembling and ship erection in the new shipyard of the Ferguson Steel & Iron Co., Buffalo, N. Y., is to be done under cover in a shop 125 ft. wide and 800 ft. long, covering the berths. The plant lies along the Buffalo River, into which the completed boats will be side-launched. At present four small boats, all Navy tugs, are on the stocks, and most of the shops, buildings, tracks and offices of the new plant are complete. The erecting shop over the berths has only just been begun, but the ships under way will be inclosed by the time cold weather sets in. As the site of the yard was open country on a poorly bulkheaded river last June, the speed with which the operation has been carried out is considered no small part of its distinction.



SITE OF THE FERGUSON SHIPYARD AT BUFFALO IN JUNE WHEN WORK WAS FIRST STARTING

The Ferguson company has conducted a warehousing and structural-steel business in Buffalo since 1913, and has rapidly increased its plant, until at present it covers some 28 acres and is capable of turning out about 2500 tons of structural material a month. Early this year it obtained contracts for fabricating and erecting Navy tugs and New York State Barge Canal barges, and determined to build on the Buffalo River, some two miles from its main plant, a shipyard at which it could not only erect the ships at present contracted for, but which would be a permanent shipbuilding plant. In order to guarantee prosecution of work throughout the severe Buffalo winter, it was decided to inclose the shipways, a procedure unique in lake shipbuilding practice. Future plans include the erection of a fabricating shop in the shipyard, but for the present, at least, all fabrication is to be done at the company's main plant.

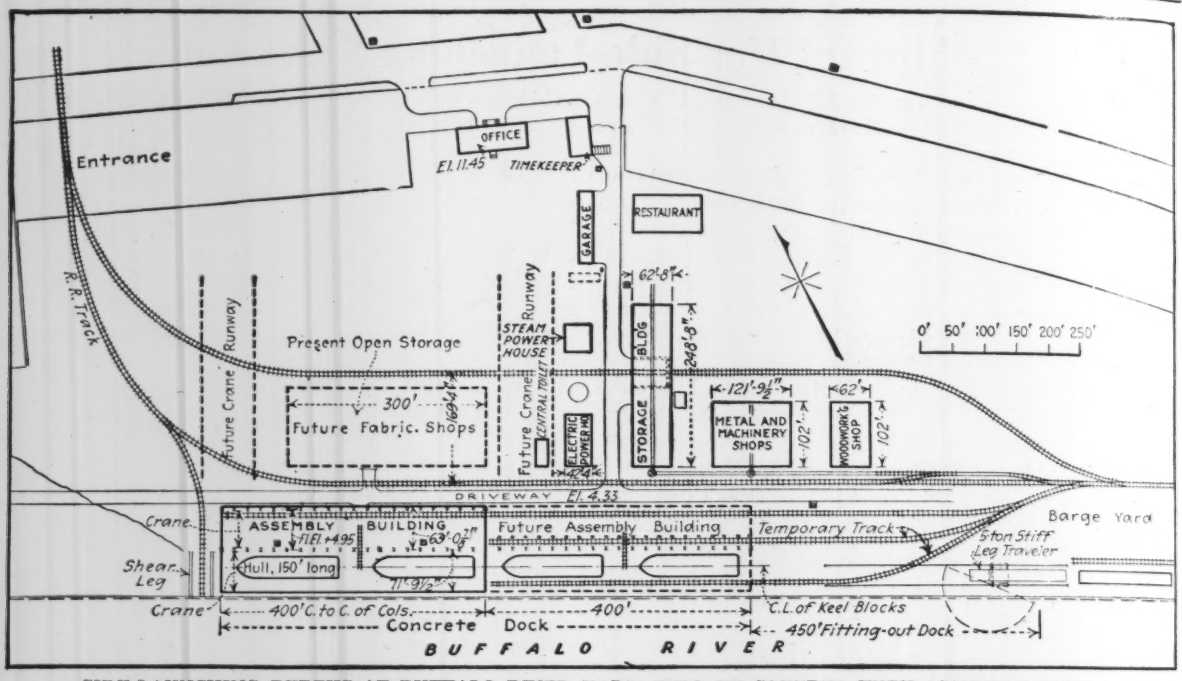
The shipyard occupies a site of about 33 acres, with a frontage of about 3000 ft. on the Buffalo River, which here has a depth of 20 ft. On this site, which in June was a rough waste, there have been built a general office building, and timekeeper's office and hospital at the street entrance, and in the yard area toward the river the plant buildings, comprising a garage, a restaurant, a steam and an electric power house and the separate shops for metal and machine working, wood working and storage. These shops are all so arranged that they can be extended shoreward from the present units in case future operations should demand a larger plant. All the shop buildings are of steel frame, with walls of stucco on metal lath.

Ships will be assembled on continuous ways paralleling the river front for a distance of about 800 ft. Along this front a new dock wall had to be built. This wall consists of a head wall of concrete at the water side, resting on embedded straight and battered piles with a row of Wakefield sheetpiles, also embedded in the concrete, to retain the fill. The concrete block is reinforced longitudinally as shown, and with cross rods carrying around the longitudinal rods and up into the upper part of the block. Tie-rods connect through the headblock of the dock wall back through the concrete keel-block foundation to the concrete footing under the shoreward columns of the assembly building. Additional protection against outward movement is had by lapped piles laid lengthwise along the outer piles under the keel-block stringer.

The assembly building is the structure of peculiar interest in the plant. As shown in the drawing, it is a two-bay steel structure, the shore bay of which is covered with an ordinary truss roof, and the waterside bay with a roof cantilevered out from the middle row of columns. For the present, and until the erection of the future fabricating shop, at least, the inshore side of the building will be completely inclosed. Material enters the landward bay by a standard-gage railroad track shown in the first drawing. The shore bay is to be used for steel storage and general assembly, and is commanded by a 10-ton girder crane spanning the outside and middle lower columns.

The waterside bay covers the berths. Running in this bay is a 10-ton semi-gantry crane, the inner end of which travels on a crane girder bracketed from the middle row of columns, while the outer end travels on a rail on the inside edge of the dock wall. Complete inclosure of the berth is effected by a continuous line of doors guided at the top from a stringer dependent from the cantilever truss, but rolling on tracks also on the concrete of the dock wall.

The berth foundation consists of a continuous concrete keel-block stringer some feet below the ground level of the berth and supported on pile footings on which keel blocks are set up according to the dimensions



SIDE-LAUNCHING BERTHS AT BUFFALO RIVER YARD WILL BE COVERED WITH ASSEMBLY SHED

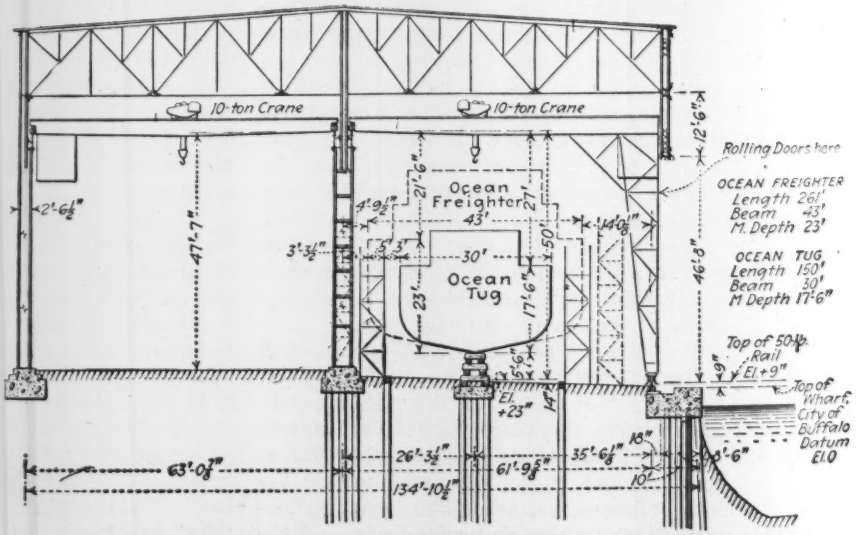
of the ships being erected. Additional sills on either side of the keel block, supported on piles, will serve as footings for shores. As shown in the cross-section, the present tugs under way do not come near occupying all of the clear space in this shed. Provision is made for the future erection of a vessel of 261 ft. length, 43 ft. beam and 23 ft. molded depth.

The launching ways will be laid across the floor of the berth over the rails of the gantry crane and of the rolling doors, neither of which have to be disturbed during the launching operation, and will have their outer ends resting directly on the head wall of the dock. A total drop of about 10 ft. will be required to launch the vessel.

The erection of the hulls now under construction is being carried out by means of locomotive cranes traveling on the final and temporary tracks shown in the drawing. These cranes will be continued in the ship erection until the traveling cranes inside the buildings are available. The assembly building will be first erected complete over the two upper hulls, which are the latest two to be started and the construction of which will run into the winter before completion. The two lower hulls should be launched before cold weather sets in, and the assembly building is not to be hurried over those, although the columns and the track for the gantry will be put up so that the erection can be continued with these machines. The middle line of columns which carries the crane will be braced and held in position by batter posts until the building is completed.

Entrance for material to the yard is effected through a single main, standard-gage railroad at the upper end. This track passes through the storage warehouse, so that material can be unloaded and distributed there, and also branches off so that it passes along the street between the assembly building and the main shop of the plant.

Switches at the lower end divert the track to the shops, where turntables permit the entrance of trucks or cars over standard-gage trucks into the shops themselves.



CROSS-SECTION THROUGH ASSEMBLY SHED SHOWS CANTILEVER COVER OF BERTHS

Another switch leading to a track running into the main assembly building will be used for the transportation of fabricated steel to the ships. A further branch of the main track goes directly to the river at the upper end of the assembly building, where either a shear-legs or an 80-ton derrick will be installed to place the engines and boilers in the hulls. After being launched, the ships will be brought down the river to the finishing dock, which lies directly below the assembly building. Handling equipment for this dock has not been decided upon.

Steel barges for the New York State Barge Canal are also being assembled by the company at the lower end of its plant. These boats are of the simplest steel-frame construction; their erection is handled entirely by locomotive cranes which travel on the adjacent track. No bulkhead has been put in here, but the building ways have been set up on piles and the barges will be side-launched on a rather steep slope. The barge frames and shell are fabricated at the company's main plant and are brought to the shipyard by train or truck.

Capt. James E. Ferguson, president, is the active head of the company. Edward P. Butts is manager of the shipbuilding department, and Thomas Leach is chief engineer of the company. Plans for the shipyard layout were made in Mr. Leach's office.

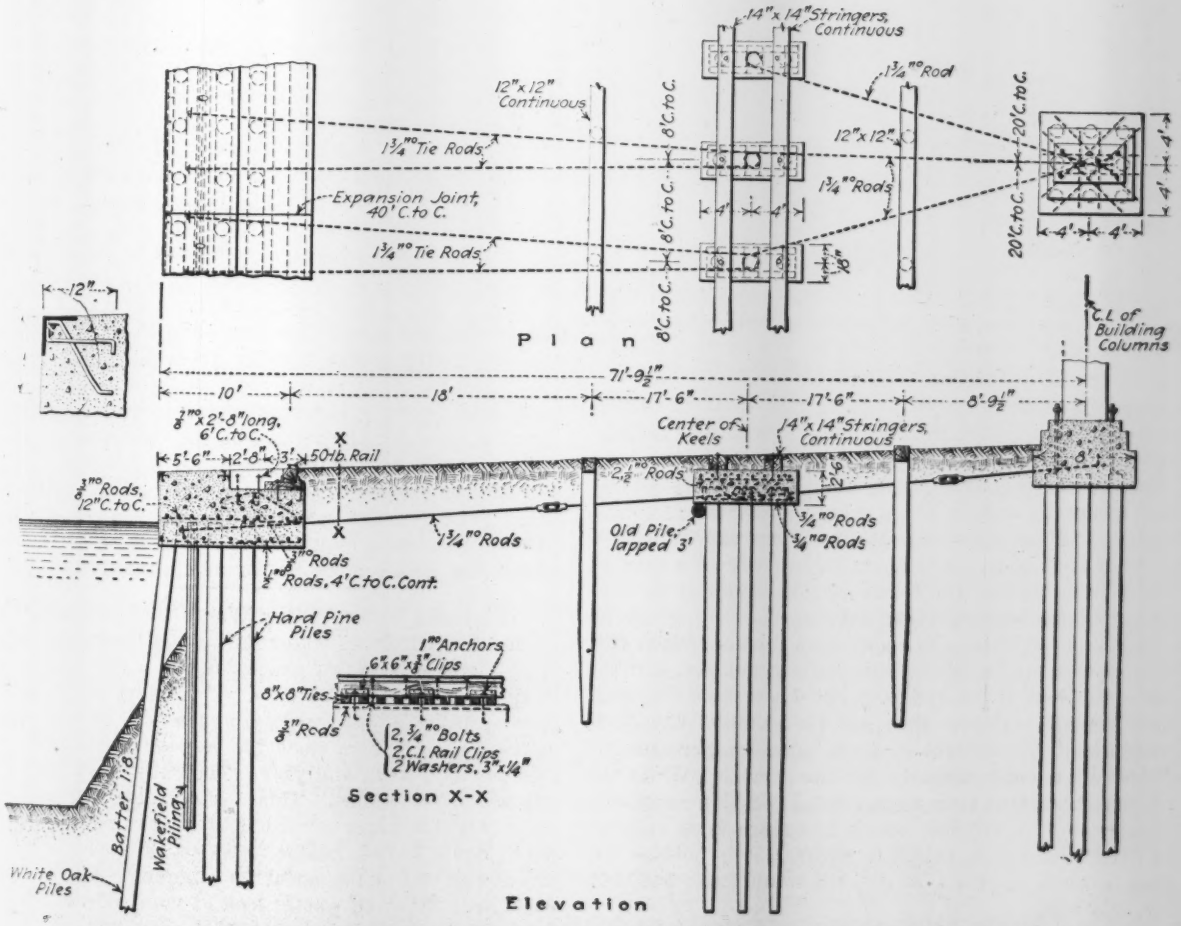
Inadequate Patrol and Dry Peat Raise Fire Loss

Meager Allotments for Minnesota Ranger System Blamed for Damage — Overdrainage Called Contributory Cause

(From St. Paul Correspondent of Engineering News-Record.)

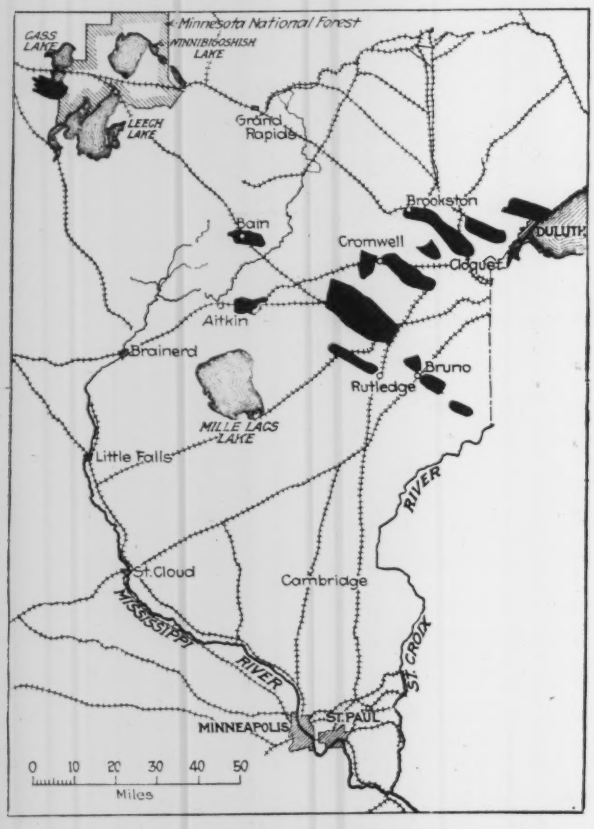
THE overdrainage of peat lands, with their consequent lack of protection, was responsible in great part for the recent Minnesota forest fires, reported in *Engineering News-Record* of Oct. 31, p. 822, according to officials of the state forest service. Lack of funds to support adequately a sufficient force of forest rangers, and lack of control over these dry peat lands, in which the fire spread, caused uncalled-for damage, it is said. in fact, the state legislature which cut the appropriations for the forest service is charged by many with the responsibility for the disaster. Inadequate legislation and lax enforcement of what laws do exist to curb the practices responsible for fires are also suggested as contributory causes.

There were numerous fires in progress at the same time, as explained in the news item mentioned above, and as shown upon the accompanying map. These took the direction of the wind, which was traveling about 60 miles per hour, and by this very action, while the



NEW CONCRETE DOCK WALL AND BERTH FOUNDATION AT FERGUSON YARD AT BUFFALO

flames covered long distances, they did not spread laterally, being pinched in. Many freakish things happened, similar to those that are noted in tornadoes, the fire jumping sometimes from one man's timber across a wooded farm to another tract. In one instance, the fire appears to have been stopped by the burning of the village of Cloquet, and while the entire village was burned up and even the ashes carried away, leaving the site practically clean, the grass was green a few hundred



TERRITORY COVERED BY RECENT FOREST FIRES IN MINNESOTA SHOWN IN BLACK

yards beyond the village. It is thought that the intense heat produced by the burning buildings caused such an upward draft that the fire was sucked up and out.

In fires of this magnitude, entailing a heavy loss in both property and in lives, many questions are asked, such as, "What was its cause?" There are 53,000,000 acres of land in Minnesota, one-half of which is wooded, and it is stated that the forest service organized in 1911 was entirely inadequate to take care of so great an amount of territory. Not only does it appear that this service was inadequate as originally organized, but the appropriations for it had been cut down from the orig-final amount. Forest fires are preventable, but, it is maintained, the control of them must be permanently upheld by a fund adequate for the service. While the maximum amount ever appropriated for this service in Minnesota was $75,000, which has since been reduced to $40,000 and then raised to $50,000, it is pointed out that 1c. an acre, or a 1/30-mill tax would raise $530,000 for this work.

The state forestry service has many stubborn things to contend with. One of these is the idea that fires improve a new country. This viewpoint naturally leads to the starting of such fires, and the laws are entirely inadequate to cope with the situation. In fact, when the forest rangers have brought those responsible to justice, it is said that the courts refused to discourage the burning of wild land by punishing the men known to have started the fires.

One of the dangerous aspects in Minnesota, according to W. T. Cox, the state forester, is the overdrainage of peat lands and leaving them without control; another is the insufficient control of logging in a state where there are 2200 logging camps in existence every winter. Unregulated scattered settlements exist throughout the great forest areas, and the state has no land policy which can concentrate the settlements. Together with better regulation of the railroads, all these things, it is maintained, should be taken up and suitable laws passed to correct the difficulties.

More than ever before, the value of good roads has been shown, according to state highway officials, and the highway department, due to the fire, has a great problem upon its hands to fix up the cheaply constructed earth roads in the burned area. The surface, formed by using the peat formation along the roads to crown them, has been entirely burned off in many cases, and the wooden bridges and culverts have been destroyed. A more suitable type of surfacing for these roads is suggested.

Emergency measures are being taken by the state highway department under the guidance of C. M. Babcock, state highway commissioner, to repair the roads which have been damaged and to put out the fires which are still burning in the surfacing. To carry on this work it has been necessary to call upon the $50,000 state reserve fund to make repairs. One highway near Aitkin, built along a drainage ditch—in fact, built from the excavation of the ditch—had a fire in its surfacing for some time after the general conflagration had subsided. To put this out a fire engine was placed at the river outlet and the ditch dammed and filled with water; another engine pumped water from the ditch at its upper end to apply to the road, while a great deal of work was done by carrying water in pails. By this means a considerable portion of the road was saved.

Governor Burnquist has appointed a commission empowered to subpoena witnesses and make a thorough investigation of the responsibility for the catastrophe. The commission is requested to report at an early date, suggesting better methods for administration.

Pictures Show Water Waste to Consumer

That little drops of water falling continuously make a mighty waste is shown graphically in a recent circular of the Indianapolis Water Co. Three cuts show faucets flowing drops, a $\frac{1}{32}$-in. stream and a $\frac{1}{8}$-in. stream, while figures beneath them show the respective losses in gallons per day, week and year. The daily wastes are 15, 264 and 2788 gallons. This circular also lists various ways in which water is wasted, and says that under war conditions it is inexcusable to waste water and so cause loss of fuel and money spent for pumping. Three points made are: "Stop all waste; look at your fixtures; listen for leaks."

Gasoline Consumption Tests Demonstrate Value of Hard, Smooth-Surfaced Roads

Gasoline Saving Which Would Pay For the Construction of a Hard Surface in a Few Years Is Indicated Between Earth and Smooth Concrete, Where a Daily Motor Traffic of 500 Can Be Expected

By A. N. Johnson
Consulting Highway Engineer, Portland Cement Association Chicago, Ill.

TESTS carried on by the Portland Cement Association, using five 2-ton trucks placed at its disposal by the White Co., have shown the value of smooth, hard surfaces in promoting the efficiency of truck operation. A remarkable agreement among the individual trucks used in the test under the same conditions was noted. The poorest surface, the earth, required 204 per cent. more consumption of gasoline than the smooth concrete, and the saving recorded between the two would pay toward the construction of the smooth surfacing at the rate of $3000 per mile per year on a road carrying a daily traffic of 500 motor vehicles. The purpose of the tests was the determination of the relative amount of gasoline actually consumed in the operation of trucks over different types of road surfaces; more particularly, to determine the difference in gasoline consumption in operation over hard, smooth-surfaced roads and those not so improved.

Selection and Description of Test Roads

The first element of the problem was the selection of suitable pieces of road in the vicinity of Cleveland, to accomplish which a number of days were spent. Some 17 sections were first selected and designated by letter. They were so nearly level that whatever grades there were would have little or no effect on the final results. After the roads were located on the map and a route was outlined, it was found that it would be impossible to cover the 17 sections in a single day. Owing to the possible influence that changing weather conditions might have, it was deemed desirable that a day's run should include all of the test sections. Finally, a group of eight sections was chosen which could be covered in one day.

On account of the limitations thus imposed, it was not possible to include all of the pavement types originally selected. A brief description of those over which the tests were run follows. In addition, there are included typical photographs which will give a clearer idea of the surface conditions than can be given by word description.

Section P—Earth Road—Located on the St. Clair road in Cuyahoga County, adjoining the Lake County line. General direction southwest. Length 2.39 miles. This road is over clay soil, extending alongside a brick road. The road is used very little, and there were no ruts. Due to rainy weather prior to Sept. 4, the surface was slightly muddy, but it was firm immediately below this thin, soft top. It may be designated as an earth road in generally fair condition.

Section O—Gravel Road—A continuation of the St. Clair road into Lake County. General direction northeasterly. Length 1.70 miles. The west quarter of a mile is somewhat loose and a little rutted, with a few small chuck holes; the remainder of the road is smoother, although somewhat uneven. It may be designated as a gravel road in generally fair condition.

Section L—Gravel Road—Located on the Reynolds road in Lake County, extending in a northerly direction from a point 100 yd. north of the New York Central R.R. crossing, for a distance of 3.58 miles. This is a gravel road in excellent condition, carefully maintained.

Section I—Bituminous Macadam—Located on Euclid Ave. in Cuyahoga County near the Lake County boundary, extending thence in a southwesterly direction for a distance of 2.61 miles. Originally a water-bound macadam, this road was afterward resurfaced with asphalt penetration macadam. The road has been repaired many times. The bituminous surface is unbroken, although it has become uneven and incipient chuck holes are forming. A number of these were being repaired during the days of the tests.

Section R—Brick Road—Located on Euclid Ave. about three miles from the Cuyahoga County line in Lake County, extending in an easterly direction. Length 1.16 miles. This road has a cement grout filler, is laid on a sand cushion and is typical of a majority of the brick roads about Cleveland. The road receives maintenance yearly, is somewhat worn, but is generally in fair condition.

Section PB—Brick Road—Located on the St. Clair road in Cuyahoga County, immediately alongside of Section P, above described. It is the same length as Section P—2.39 miles. This road has a cement grout filler and is laid on a sand cushion. It is not traveled much and is in fine condition, the surface being extra smooth.

Section K—Brick Road—Located on Euclid Ave. in Lake County, beginning at a point near the intersection of Reynolds Road and extending northeasterly 5.61 miles for the run made Sept. 4, while the test section used for the runs Sept. 5 and 6 was 4.22 miles. This road is laid on a sand cushion, has a cement grout filler and is probably the best section of brick road to be found in the neighborhood of Cleveland, the surface being exceptionally smooth.

Section M—Concrete Road—Located on Euclid Ave. in Lake County, beginning at a point east of Painesville at the intersection of the River Road and extending northeasterly 5.61 miles for the test run made Sept. 4 and 4.39 miles for the runs of Sept. 5 and 6. This is a two-course concrete road laid in 1916, is reinforced with mesh and has metal protected joints. The surface is generally good, although at the joints there is a slight unevenness.

Description of Trucks

The trucks used in the tests were five new White, 2-ton double reduction gear driven trucks that had been run but a few miles, sufficient only to put them in gen-

eral adjustment for operation. They are the type of truck furnished by the White Co. for the United States Army and known as United States Army Standard A truck. They were provided with wooden bodies but did not have canopy tops. The trucks were arbitrarily numbered from 1 to 5 and are referred to by the numbers. At the time of making the tests the trucks had not been accepted by the Army officers. Their weight as operated empty was 5500 pounds.

Gasoline-Measuring Apparatus

In order to make accurate determinations of the amount of gasoline used, there was attached to the footboard of each truck a small tank, holding approximately 1 gal., being one of the stock tanks used on White trucks for lubricating oil. To each tank was attached a glass gage tube. By placing against the glass gage an engineer's scale, graduated to inches and tenths, the height of the gasoline in the tank could be interpolated to the nearest 0.01 in. These tanks were each calibrated by filling them with 100 c.c. of gasoline at a time, and recording the height of the gasoline as shown in the gage tubes.

The results of the calibration measurements showed remarkable accuracy in the construction of these small tanks, in that they are practically of uniform size. It so happened that 1 in. in height on the gage was within one or two thousandths of a gallon of being exactly 0.1 gal. From the average of these readings and the known quantity of gasoline added to the tanks a coefficient was obtained by which the readings in inches on the gages of each tank could be reduced to gallons. These coefficients were as follows: Truck 1, 0.0996; truck 2, 0.0985; truck 3, 0.0996; truck 4, 0.0975; truck 5, 0.0999.

Leading from the test tank was a tube that connected with the tube feeding the gasoline from the main supply tank to the carburetor. Just below the test tank was inserted a valve V_2 and in the main tube from the main tank to the carburetor there was also a valve V_1. A sufficient quantity of gasoline for making the tests was set aside, so that the same quality of gasoline would be used throughout the tests. As determined in the laboratories of the White Co., this gasoline tested 57° gravity Baumé, and 93% of it had distilled or evaporated under 450° Fahrenheit.

Meteorological conditions were obtained from the United States Weather Bureau station at Cleveland for the days on which the test runs were made: viz., Sept. 4, 5, 6 and 7, and are summarized in Table I.

Methods of Making Test Runs

In conference with engineers of the White Co., it was decided to make test runs as follows: One series with the trucks run empty but on third gear and at a uniform speed of 15 miles per hour, the trucks used having four gears or four speeds; a second series run at a uniform speed of 15 miles per hour on third gear, but with a 2-ton load; a third series with the trucks loaded but on fourth gear, the trucks to be operated as they would be in practical use—that is, where the road was rough or uneven and 15 miles an hour would cause too much jolting, the speed was to be reduced accordingly, while on the smooth roads it was to vary from 15 to 18 miles per hour; a fourth series with the trucks run empty on fourth gear. The third and fourth series were designated as "commercial runs."

TABLE I. METEOROLOGICAL CONDITIONS OF TEST[illegible] TAKEN FROM RECORDS OF WEATHER BUREAU

	Sept. 4	Sept. 5	Sept. 6	Sept. 7
Precipitation	p.m., 0.09 in.	Numerous showers	0	0
Character of day	Cloudy, mis-ty, occasionally; sunshine in a.m.	Cloudy, mis-ty; little sunshine	Clear sun-shine	[illegible] sun-shine
Prevailing wind	Northeast..	North...	North	[illegible]
Average hourly velocity	10.8 m.p.h.	22.0 m.p.h.	12.1 m.p.h.	[illegible] m.p.h.
Reduced barometer	a.m. 30.13, p.m. 29.85	a.m. 29.84, p.m. 30.04	a.m. 30.09, p.m. 30.08	[illegible] 30.12, [illegible] 30.07
Relative humidity	a.m. 87, p.m. 95	a.m. 90, p.m. 76	a.m. 67, p.m. 54	[illegible] 57
Dry temperature, noon	68 5°	58 0°	60 1°	[illegible]
Wet temperature, noon	65 0°	56 0°	51 1°	[illegible]
Dew point	64 0	55 0	43 0	[illegible]
Vapor pressure	0.595	0.432	0.277	[illegible]

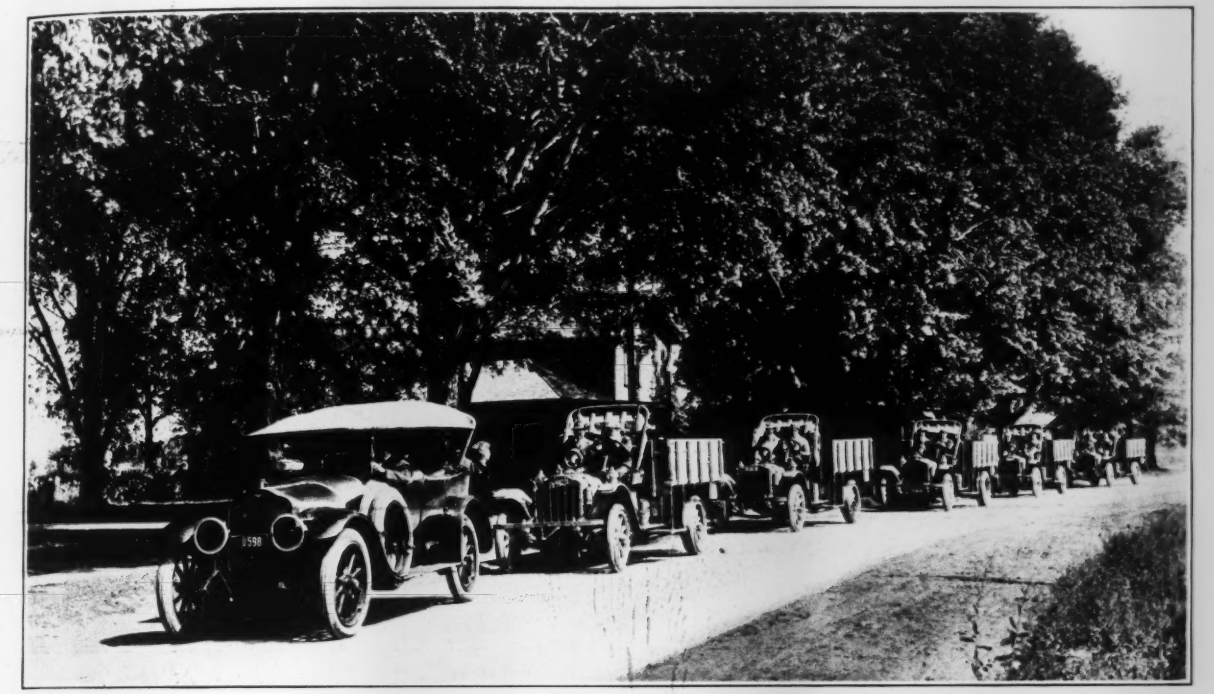
In general, this program was followed, but not completely on all the test sections, because it was impossible to give immediate attention to the necessary detailed arrangements for a prompt start each day. The time for making the tests was therefore in some instances so limited that not all of the test sections could be covered. Again, owing to rain, the condition of the earth road had become somewhat slippery, and it was not possible on Sept. 5 to run the trucks loaded over it unless chains had been attached, and as the chains might mar the tires, it was undesirable to use them. The data secured, however, are considered reasonably complete.

Observer and Signal Man Checked Consumption of Gasoline Used

An experienced driver was furnished by the White Co. for each car. With each driver there was an observer. At the beginning and end of each test section, a card with the letter of the section was placed alongside the road. The trucks would line up in order, 100 yd. or more from the test section, and at a given signal would get under way, using the gasoline from the main supply tank—that is, with valve V_1 open and valve V_2 closed. As each truck passed the beginning of the section, the observer closed valve V_1 and immediately opened valve V_2. At the ends of each test section a signal man was stationed, and as each truck completed its run the observer closed valve V_2 and opened valve V_1, so that during the passage of each truck over the test section all the gasoline consumed during the run was supplied from the test tank.

Before each run, the height of the gasoline in the gage was measured, and the observer noted the same on a slip provided for the purpose: A check reading was made by another observer, and the reading already set down on the slip was checked. At the end of the run, similar readings were again made, and the difference in the height of the gasoline gave the amount in inches of gasoline consumed by the test run. Care was taken that the operation of the truck while gage readings were being made was practically level, this being checked by a small machinist's level placed upon the frame of the truck. These readings in inches were then reduced to gallons by multiplying the readings for each truck by its appropriate coefficient. The results for each test run for each truck are given in the accompanying Table II.

Five Trucks Used in Gasoline Consumption Tests, and Eight Roads on Which the Tests Were Made



PILOT CAR, AND FIVE TWO-TON TRUCKS USED FOR GASOLINE CONSUMPTION TESTS

LEFT—SECTION P, EARTH ROAD, GENERALLY FAIR CONDITION—GASOLINE CONSUMPTION WITH TWO-TON LOAD, 0.1730 GALLONS PER MILE, 5.78 MILES PER GALLON

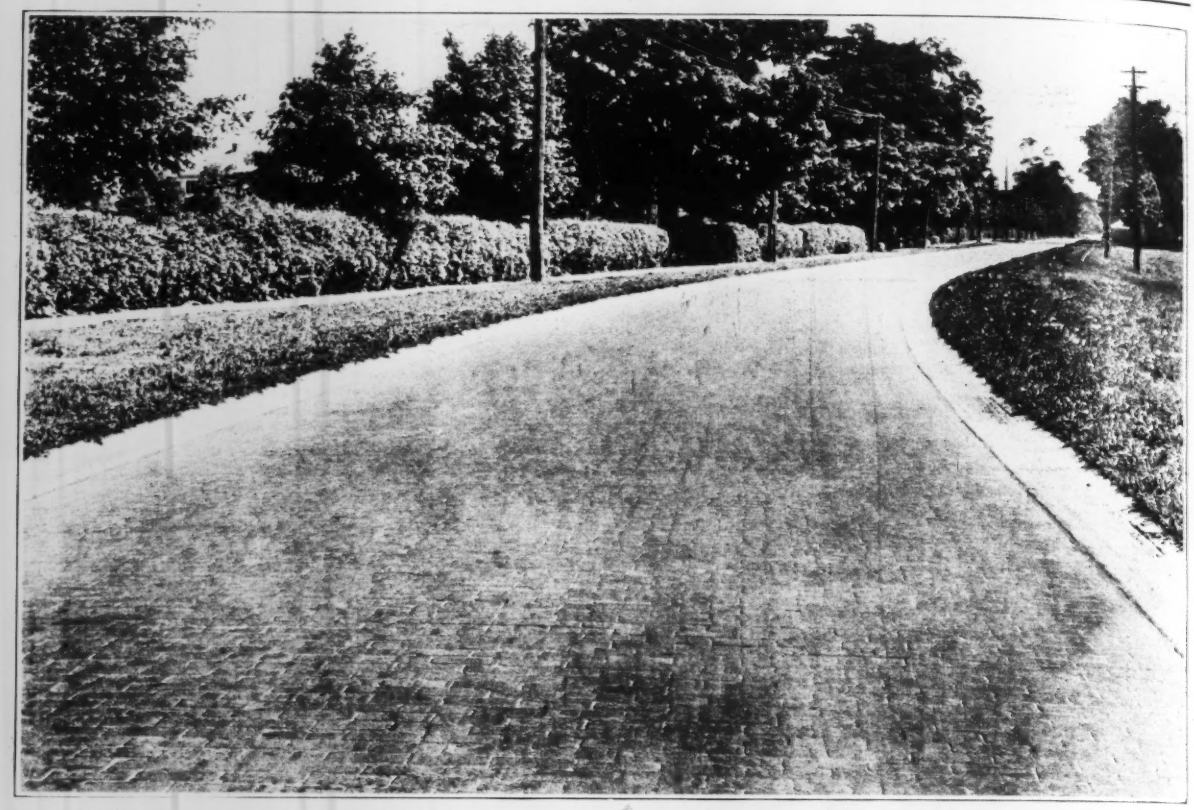
RIGHT—SECTION PB, BRICK ROAD, EXTRA GOOD—GASOLINE CONSUMPTION EMPTY, 0.0738 GALLONS PER MILE, 13.55 MILES PER GALLON—NO TEST MADE WITH TWO-TON LOAD

SECTION O—GRAVEL ROAD, FAIR CONDITION—GASOLINE CONSUMPTION WITH TWO-TON LOAD, 0.1390 GALLONS PER MILE, 7.19 MILES PER GALLON

SECTION L—GRAVEL ROAD, GOOD CONDITION—GASOLINE CONSUMPTION WITH TWO-TON LOAD, 0.1063 GALLONS PER MILE, 9.39 MILES PER GALLON

SECTION I—BITUMINOUS MACADAM ROAD, SOMEWHAT WORN AND UNEVEN, GENERALLY FAIR CONDITION—GASOLINE CONSUMPTION WITH TWO-TON LOAD, 0.1054 GALLONS PER MILE, 9.48 MILES PER GALLON

SECTION R—BRICK ROAD, GENERALLY FAIR CONDITION, BUT WITH PATCHED PLACES SHOWING GENERAL WEAR—GASOLINE CONSUMPTION WITH TWO-TON LOAD, 0.1012 GALLONS PER MILE, 9.88 MILES PER GALLON



SECTION K—BRICK ROAD, GOOD CONDITION, EXTRA SMOOTH—GASOLINE CONSUMPTION WITH TWO-TON LOAD, 0.0875 GALLONS PER MILE, 11.44 MILES PER GALLON

SECTION M—CONCRETE ROAD, GOOD CONDITION—GASOLINE CONSUMPTION WITH TWO-TON LOAD, 0.0849 GALLONS PER MILE, 11.78 MILES PER GALLON

Table III is a summary table for each test section, using the averages obtained from the five trucks. The gasoline consumed in making a run was first ascertained over the section in one direction, called "in," and then for the opposite direction, indicated as "out," so that by averaging the results on a particular section for "in" and "out" readings the influence of the slight grades and wind would be practically balanced. In the summary table all results are reduced to gallons per mile for each type of road surface.

TABLE II. GASOLINE CONSUMPTION IN GALLONS PER MILE

Truck Number	Trucks Empty, Sept. 4, 15 Miles per Hour on 3rd Gear		Trucks Loaded, 2-Tons, Sept. 5, 15 Miles per Hour on 3rd Gear		Trucks Loaded, 2-Tons, Sept. 6, "Commercial Run" on 4th Gear		Trucks Empty, Sept. 7, "Commercial Run" on 4th Gear	
	Out	In	Out	In	Out	In	Out	In
Section P—Earth Clay—A Little Mud—Generally Fair—Length of Test, 2.39 Miles								
1	0.151	0.115	.....	.....	0.154	0.160	0.096	0.085
2	0.172	0.146	.....	.....	0.240	0.207	0.136	0.131
3	0.130	0.102	.....	.....	0.185	0.150	0.099	0.084
4	0.147	0.126	.....	.....	0.167	0.158	0.105	0.099
5	0.128	0.114	.....	.....	0.171	0.138	0.095	0.093
Total	0.728	0.603	.....	.....	0.917	0.813	0.531	0.491
Average,	0.1331		.....		0.1730		0.1022	
Section O—Gravel—Fair Condition—Length 1.70 Miles								
1	0.103	0.079	.....	.....	0.140	0.107	0.072	0.076
2	0.140	0.134	.....	.....	0.176	0.167	0.110	0.117
3	0.103	0.091	.....	.....	0.142	0.127	0.085	0.088
4	0.119	0.121	.....	.....	0.137	0.132	0.091	0.098
5	0.115	0.116	.....	.....	0.133	0.129	0.089	0.092
Total	0.580	0.541	.....	.....	0.728	0.662	0.447	0.471
Average,	0.1121		.....		0.1390		0.918	
Section L—Gravel—Good Condition—Length 3.58 Miles								
1	.....	.....	0.134	0.149	0.097	0.093	0.082	0.071
2	.....	.....	0.173	0.166	0.133	0.128	0.119	0.105
3	.....	.....	0.143	0.135	0.106	0.095	0.083	0.075
4	.....	.....	0.138	0.134	0.110	0.102	0.092	0.085
5	.....	.....	0.131	0.130	0.103	0.097	0.088	0.078
Total	.....	.....	0.719	0.714	0.548	0.515	0.464	0.414
Average,	.....		0.1433		0.1063		0.0878	
Section I—Bituminous Macadam—Somewhat Worn and Uneven—Length 2.61 Miles								
1	0.093	0.084	0.102	0.084	0.105	0.088	.....	.....
2	0.125	0.120	0.136	0.121	0.126	0.123	.....	.....
3	0.080	0.088	0.105	0.096	0.106	0.098	.....	.....
4	0.105	0.086	0.113	0.099	0.110	0.099	.....	.....
5	0.101	0.085	0.104	0.096	0.103	0.096	.....	.....
Total	0.504	0.463	0.560	0.496	0.550	0.504	.....	.....
Average,	0.0967		0.1056		0.1054		.....	
Section R—Brick—Fair to Good—Somewhat Worn—Length 1.16 Miles								
1	0.095	0.079	0.109	0.086	0.104	0.078	.....	.....
2	0.122	0.114	0.140	0.119	0.124	0.116	.....	.....
3	0.109	0.086	0.110	0.094	0.110	0.087	.....	.....
4	0.097	0.087	0.112	0.087	0.111	0.089	.....	.....
5	0.099	0.092	0.105	0.088	0.100	0.093	.....	.....
Total	0.522	0.458	0.576	0.474	0.549	0.463	.....	.....
Average,	0.0980		0.1050		0.1012		.....	
Section PB—Brick—Extra Good Condition—Length 2.39 Miles								
1	.....	.....	.....	.....	.....	.....	0.066	0.063
2	.....	.....	.....	.....	.....	.....	0.096	0.096
3	.....	.....	.....	.....	.....	.....	0.059	0.068
4	.....	.....	.....	.....	.....	.....	0.071	0.075
5	.....	.....	.....	.....	.....	.....	0.071	0.073
Total	.....	.....	.....	.....	.....	.....	0.363	0.375
Average,	.....		.....		.....		0.0738	
Section K—Brick—Good, Extra Smooth—Length, Sept. 4, 5.61 Miles; Sept. 5-6, 4.22 Miles								
1	0.077	0.076	0.085	0.081	0.086	0.077	.....	.....
2	0.101	0.109	0.122	0.116	0.109	0.106	.....	.....
3	0.080	0.077	0.089	0.089	0.085	0.082	.....	.....
4	0.084	0.080	0.096	0.087	0.084	0.087	.....	.....
5	0.086	0.080	0.097	0.087	0.080	0.079	.....	.....
Total	0.428	0.422	0.489	0.460	0.444	0.431	.....	.....
Average,	0.0850		0.0949		0.0875		.....	
Section M—Concrete—Good Condition—Length, Sept. 4, 5.61 Miles; Sept. 5-6, 4.39 Miles								
1	0.083	0.071	0.098	0.085	0.080	0.074	.....	.....
2	0.106	0.092	0.134	0.118	0.110	0.098	.....	.....
3	0.086	0.076	0.106	0.088	0.084	0.079	.....	.....
4	0.091	0.078	0.106	0.087	0.090	0.078	.....	.....
5	0.092	0.076	0.107	0.088	0.081	0.075	.....	.....
Total	0.458	0.393	0.551	0.466	0.445	0.404	.....	.....
Average,	0.0851		0.1012		0.0849		.....	

It will be noted that there is in general a remarkable agreement between the different trucks with the exception of truck 2, which in all instances shows a somewhat higher gasoline consumption than the other four trucks. This may be explained by the fact that the size of the opening to the carburetor for this truck is probably slightly larger than for the others.

In general, it will be noticed that the consumption of gasoline in one direction is more than in the other direction on a given test section of road, and that this is true for each individual truck. There are, however, four or five exceptions to this, believed to be due to the transferring of readings that should have been indicated as "out" runs under the heading "in." However, as an examination of the original records does not show that such errors were made, the results are given exactly as recorded.

Reference to the summary table will disclose the most significant conclusions to be drawn. The operation of the trucks on third gear, which is direct and at uniform speed, evidently does not give the true relative difference in gasoline consumption. On smooth, hard roads, when the truck is operated on third gear there is a certain waste of gasoline, while on the softer roads, or those pulling harder, there is not so much difference.

The results obtained with the trucks loaded with two tons, operated on fourth gear on "commercial runs," as indicated in the third column of the summary table, tests made Sept. 6, probably furnish the most instructive data. It will be seen here that the amount of gasoline consumed per mile on the hard, smooth roads—concrete and the smooth brick—is about 0.085 gal. of gasoline, as compared with a consumption of 0.173 gal. on the earth road, or 204% of the quantity of gasoline used over the hard, smooth surfaces.

In proportion as the surface of the road was of a character that offered greater resistance, the increase in the amount of gasoline is to be noted. Thus, on the brick road which was somewhat worn there was an increase of 19%; on the bituminous macadam 24%; on the good gravel 25%, and on the fair gravel road 64% of the amount of gasoline consumed over the hard, smooth surfaces. Or, to state the results in terms of miles per gallon of gasoline, 5.78 miles would be made over the earth road, 7.19 over the fair gravel road, 9.39 over the good gravel road, 9.43 on the fair bituminous macadam road, 9.88 over the fair brick road, 11.44 over the extra smooth brick road and 11.78 over the good concrete road.

Economy of Hard, Smooth Roads

These results furnish a sound basis for some reasonably definite conclusions as to the economy of constructing roads that will have and maintain a hard, smooth condition of surface. An illustration of the use of these data for such purpose can be made in the instance of the projected state system of highways for Illinois, for which there is proposed a bond issue for $60,000,000 to build approximately 5,000 miles of highways. On the supposition that these highways develop an average traffic of 500 motor vehicles per mile per

TABLE III. SUMMARY OF RESULTS OF GASOLINE CONSUMPTION IN GALLONS PER MILE, OVER VARIOUS TYPES OF SURFACE ON LEVEL ROADS—PERCENTAGES BASED ON MINIMUM AVERAGE CONSUMPTION FOR EACH DAY'S TESTS

Type of Road Surface Section Letter and General Condition	Trucks Empty, Sept. 4, 15 Miles per Hour on 3d Gear Gas, Gal.	%	Trucks Loaded, 2 Tons, Sept. 5, 15 Miles per Hour on 3d Gear Gas, Gal.	%	Trucks Loaded, 2 Tons, Sept. 6, "Commercial Run" on 4th Gear Gas, Gal.	%	Trucks Empty, Sept. 7, "Commercial Run" on 4th Gear Gas, Gal.	%
P Earth—a little mud—generally fair	0.1331	156	Rain made too slippery to operate..		0.1730	204	0.1022	138
O Gravel—fair	0.1121	132			0.1390	164	0.0918	124
L Gravel—good			0.1433	151	0.1063	125	0.0878	119
I Bituminous macadam—somewhat worn and uneven	0.0967	114	0.1056	111	0.1054	124		
R Brick—fair to good—somewhat worn	0.0980	115	0.1050	111	0.1012	119		
PB Brick (para'l line sect'n P)—extra good							0.0738	100
K Brick—good—extra smooth	0.0850	100	0.0949	100	0.0875	103		
M Concrete—good	0.0851	100	0.1017	107	0.0849	100		

day for 300 days in the year, and that the roads constructed will afford a hard, smooth surface, the saving in gasoline consumption over the operation of a similar amount of traffic, even if it were possible, on earth roads in fair condition, gives a grand total of 66,000,000 gal. per year, of an approximate value of $15,000,000, or $3000 per mile per year. This single item in fuel consumption would thus warrant the construction of the roads even at a cost considerably over the proposed amount of the bond issue.

This estimate of the value of the roads leaves out the decreased cost due to time saving in the operation of the trucks, to reduced wear and tear and therefore greater length of service to be obtained, and to tire economy, and particularly leaves out entirely the commercial value of the traffic.

Another suggestive study is made by comparing the amount of gasoline consumed because of the addition of a load of two tons on the different road surfaces. For this purpose compare the amount of gasoline per mile, 0.0849 gal., for a loaded truck over a smooth, hard surface, with the empty truck operated in similar manner over such a surface, 0.0738 gal., the difference due to the addition of two tons to the load being 0.0111 gal. Similarly, the difference due to a load of two tons on the earth road is seen to be 0.0708 gal., or nearly seven times as great as over the hard, smooth-surface road. This result bears out the increase in tractive resistance noted in the results of tests made by Prof. J. B. Davidson of the Division of Agricultural Engineering for the California State Automobile Association, published in 1917.

While the tests described in this paper are far from exhaustive, it is believed that they suggest some very significant facts in road economy. Particularly do they point to the necessity and the value of much more extended series of tests to determine not only the relative fuel consumption over various types and conditions of road surfaces, but also the fuel cost for operating on grades, on which there are at present no data whatever. The determination of a proper profile for our roads is one of the fundamental considerations of road improvement, and evidently affects vitally the fuel consumption necessary to operate a given piece of road.

Irrigation District Plan Favored in California

Experience Shows It Is Better Than Either Private or Mutual Water Companies—Irrigation District Bond Commission

ECONOMIC conditions in California now are such as to encourage greatly increasing the area under cultivation and additional acreage is being added at a rapid rate. Much of this is in irrigated tracts because that is probably the most convenient means of increasing the more valuable class of arable land. Irrigation developments are ordinarily most economical when developed so as to serve large areas, and the tendency has been to organize so as to distribute the cost as much as possible. There are three methods under which irrigation systems are developed in California: by public utility corporations, by mutual water companies, and by the formation of irrigation districts. Of these the last named now meets with more general approval than the others.

Even under conditions obtaining prior to the advent of the railroad commission the management of irrigation projects by public utility corporations was seldom successful. Since the railroad commission has exercised jurisdiction over such utilities there has been frequent statement of the belief that there is little hope of profit in such ventures and great possibility of heavy losses on the capital invested. Be this as it may, irrigation developments of importance are no longer financed in California by public utility corporations.

Mutual Water Companies

The mutual water company plan was formerly much used, particularly in southern California. Such companies are not subject to the jurisdiction of the railroad commission and tend rather toward extreme examples of the need for regulation. They are not empowered with the right of eminent domain, cannot force a minority of stockholders to conform to the majority ruling and in case of non-payment of assessments can sell only the water stock and not the land of delinquents.

From the landholder's point of view the mutual companies have the disadvantage that they can be manipulated for the profit of individuals at the expense of the farmers. Mutual companies usually originated with owners of large tracts of land, who formed companies for the sale of their land and organized mutual water companies at the same time. With each acre of land sold a share of water stock was included entitling the purchaser to an amount of water sufficient for the irrigation of his land.

In most cases lands purchased under this system were paid for on terms, and until the purchasers paid at least a majority of the money due the land company continued to vote the stock. The usual procedure, which had many variations, was for the original owners just before losing control of the water company to mortgage the water system for as near its full value as possible, and then after turning the system over to the new owners to hold a mortgage on the system which

the purchasers never contemplated when buying the lands. This procedure has now been practically stopped in California by new corporation laws.

Changes in Irrigation District Plan

The irrigation district plan has undergone many changes since first authorized by the Wright act in 1887. Soon after the passage of the act so many ill-advised districts were launched which did not do well that in a few years California irrigation district bonds could not be sold for anywhere near their face value. There were revisions of the law and various improvements were tried, but the most successful plan was not reached until 1913, when the Irrigation District Bond Commission was formed. This consists of the attorney-general, the state engineer and the superintendent of banks, and its function is to investigate irrigation districts and give approval before the securities of such districts shall be legal investments for trust companies, insurance companies, trust funds, city school funds, and in money which may be invested in bonds of counties, cities, school districts or municipalities.

Irrigation District Bond Commission

In five years of operation under the Irrigation District Bond Commission no district which has obtained its approval of securities has ever failed to meet its obligations. This fact has become known in a general way to investors. Although it is legally possible to sell irrigation bond securities which have not been approved by the Irrigation District Bond Commission, bond houses are so unwilling to buy securities not so approved that all enterprises which failed to secure the commission's approval have been abandoned.

On the other hand, securities which have been approved by the Irrigation District Bond Commission have found a much more ready sale than irrigation securities in other sections of the country, and the districts themselves have prospered accordingly. California irrigation district bonds are now selling practically at par and have found a ready market even during war times and in the face of Liberty Loans. The second issue of Anderson-Cottonwood district, aggregating more than $500,000, was sold wholesale to one of the San Francisco bond houses since the beginning of the war for approximately 96 per cent.

As the law now stands a majority of votes absolutely rules the affairs of the irrigation district, it can exercise the right of eminent domain and can sell the land of delinquents for non-payment of assessments. Finally, the U. S. Reclamation Service has indicated its preference for this plan where reclamation projects are being turned over to the management of landholders. These facts explain the popularity of the California plan and the extent to which other states are endeavoring to put the same methods into effect.

Macadam and Hard-Surface Paving Upkeep Compared

Hard Surface Favored by Washington State Official When Maintenance Exceeds $500 Per Mile Per Year

WHENEVER any macadam or gravel-surfaced section of highway requires more than $500 per mile per year for upkeep under its increasing traffic, a hard-surface pavement is overdue, on the ground of public economy. This is the conclusion drawn by G. F. Cotterill, chief engineer of the Washington State Highway Commission, from the tabulated maintenance cost records for the State of Washington. The statement was made in an address before the joint convention of the county highway engineers and commissioners, at Seattle, Wash. The uniform cost system under which these records were compiled has been in operation for about a year, and was described in *Engineering News-Record* of Apr. 4, p. 660. A brief abstract of Mr. Cotterill's address, with an explanatory table, follows.

During the six years preceding 1917 the Washington program of good roads had resulted in about 1250 miles of construction along the primary state highway routes, of which 330 miles had been improved by the counties under the permanent highway law. The counties had

EXPENDITURES FOR MAINTENANCE AND REPAIRS OF WASHINGTON PRIMARY STATE HIGHWAYS, SEGREGATED BY TYPES OF SURFACE

	(1) Brick Pavement	(2) Concrete Pavement	(3) Sheet Asphalt	(4) Asphaltic Concrete	(5) Bithulithic (Warrenite)	(6) Bituminous Macadam	(7) WB Macadam (Cr. Rock)	(8) Gravel Surfacing	(9) Nat. Earth Grade	(10) Bridges and Trestles	Totals all Types
Period June-Dec. 1917:											
Counties	1	10	2	2	3	6	14	24	4	3	29
Road sections	3	20	3	6	4	13	40	108	12	4	213
Mileage	8.81	90.59	5.97	19.74	14.41	40.21	1,159.90	792.40	109.74	2.00	1,243.77
Expenditure	$9,456.51	$5,092.45	$326.03	$319.76	$2,978.50	$5,493.49	$25,333.79	$143,311.52	$11,043.37	$8,474.47	$210,829.89
Expenditure per mile	$1,073.38	$56.21	$54.61	$16.19	$206.70	$136.62	$158.43	$180.85	$100.63	$3,737.23	$169.50
Jan.-May, 1918:											
Counties	1	12	2	2	4	6	14	27	8	7	30
Road sections	3	24	3	8	5	13	45	115	20	10	246
Mileage	8.81	102.41	5.97	23.24	17.81	40.21	174.74	839.90	168.54	3.70	1,385.33
Expenditure	$3,352.32	$2,809.97	$36.52	$225.52	$3,748.29	$4,833.66	$29,536.06	$149,379.28	$8,434.02	$17,003.10	$219,358.74
Expenditure per mile	$380.51	$27.44	$6.12	$9.70	$210.45	$120.21	$169.03	$177.85	$50.04	$4,595.40	$158.34
Combined Year:											
Expenditure	$12,808.83	$7,902.42	$362.55	$545.28	$6,726.79	$10,327.15	$54,869.85	$292,690.80	$19,477.39	$24,477.57	$430,188.63
Expenditure per mile	$1,453.89	$83.65	$60.73	$25.89	$417.15	$256.83	$327.46	$358.70	$150.67	$8,332.63	$327.84

EXPLANATIONS AND REMARKS FOR COMPARISONS

GENERAL NOTE: Figures include all expenditures upon entire highway for Maintenance, Repairs, Equipment and Supervision.
(1) BRICK PAVEMENT: Large repair expense replacing broken sections due to settlement and other defects in original construction.
(2) CONCRETE PAVEMENT: "One-course," "two-course," and "granitoid" types; one to five years old.
(3) SHEET ASPHALT: Only three sections in two counties adjacent to cities; one to four years old.
(4) ASPHALTIC CONCRETE: Mostly new work, in first or second years, requiring only nominal maintenance.
(5) BITULITHIC (Warrenite): High cost due to 6.11 miles Warrenite N. from Seattle ($783.43 per mi.); also repairing washed-out section, Yakima Co. ($561.65 per mile); remainder cost $85.59 per mile.
(6) BITUMINOUS MACADAM: Includes all oil-bound surfacings by "penetration" system; sections two to eight years old.
(7) W-B MACADAM, ETC.: Includes all crushed rock surfacings except oil-bound.
(8) GRAVEL SURFACING: Figures include resurfacing several sections but average fair as applied to all.
(9) NATURAL EARTH GRADE: Traffic much less than on other types; surfacing unnecessary or deferred.
(10) BRIDGES AND TRESTLES: Items cover special repairs or renewals on large scale of certain structures.

also constructed about 400 miles of permanent highway on the secondary state routes and at least 350 additional miles from the proceeds of county bond issues. This gave a total of about 2000 miles of highway, representing an investment of at least $15,000,000.

Prior to 1917, the maintenance of this highway system had been attended to in a haphazard manner, but in that year a law was passed which provided sufficient money and prescribed certain rules for the maintenance of the state highways by the counties in which they lie, the State Highway Department having regulative control and power to enforce standards of maintenance on primary state routes. Maintenance of the existing primary state highways now stands ahead of all other road work and must be taken care of, even it is necessary to utilize highway construction funds. The law has worked exceedingly well, and the roads were never in better condition than at present. The only exceptions are certain gravel roads on which the traffic is so heavy that they cannot be maintained successfully at any price.

In the exercise of its regulative authority the State Highway Board adopted a series of rules for the guidance of county officials. Particular emphasis was placed upon uniform maintenance cost records, and the form in which reports were to be made was given in detail. The table shows a summary of the expenditures for maintenance on the primary state routes, segregated by types of surfacing. The record covers the period from June 1, 1917, to May 31, 1918, the two years being kept separate. The number of counties reporting, the total mileage, the total expenditure and the expenditure per mile, accompanied by a statement of the particular conditions governing each type, are given.

While it is appreciated that statistics for one year do not afford an adequate basis for detailed comparisons, still the data are definite enough for the forming of general conclusions concerning the two types. In doing this, however, certain special conditions must be considered, and these have been set forth in the footnotes of the table.

Referring to the table, it is interesting to note that, during the seven months closing 1917, there was a total expenditure of $210,829.89 reported upon 1243.77 miles of primary highway, and that, during the opening five months of 1918, an additional sum of $219,358.74 was expended upon 1385.33 miles, or a total of $430,188.63 for the entire year. This makes an average expenditure per mile per year of $327.84. It is believed that this figure is high, on account of the fact that, in anticipation of the new maintenance law becoming effective on June 7, practically all the spring maintenance was held up until that date. Thus the heavy maintenance for two spring periods was carried in the one year. The present high prices have also had their effect upon the figures, and under normal conditions the annual charge may be brought down to $200 per mile.

The statement of expenditures segregated by types of pavement or surfacing present an interesting field for comparative study of general features. The first five classifications include what are commonly referred to as hard-surface pavements. For purposes of comparison, it must be recognized that the brick and bitulithic roads tabulated were extensively repaired, being practically reconstructed. Eliminating these, it can be broadly stated that the annual upkeep of approximately 150 miles of primary highways covered with hard surfaces was from $50 to $100 per mile. In sharp contrast, the next three classifications, including the various types of oil- and water-bound macadam, crushed rock and gravel surfacing, covering nearly 1100 miles, cost from $250 to $350 per mile. Here is a distinct gap of $200 to $300 per mile for annual maintenance cost, between the hard-surface and macadam gravel groups. Furthermore, it is evident that this contrast does not fully measure the gap, because the 150 miles of hard-surface pavement cover highway sections which carry double or triple the traffic that is carried by the other group.

A study of the highways by counties shows that the annual maintenance cost has varied from $75 to $900 per mile, and that this variation is directly proportional to the amount of traffic. It seems safe to conclude that, if the hard-surface pavement mileage had been of the macadam and gravel type, the annual cost for upkeep would have averaged more than $600 per mile. Therefore at least $500 per mile, or the equivalent of 5% interest on a $10,000 investment, is being saved wherever a properly built hard-surface pavement has replaced macadam or gravel on heavy traffic highways.

"Vestibule" Schools for Women Mechanics

Industrial training for female machine-tool operators is expedited by placing the women in a "vestibule" or preliminary instruction room for a few days under a competent instructor. The idea is to take away from the woman the fear of the shop and to give her a fair knowledge of the tools she is to handle. At the plant of the Lincoln Motor Co., Detroit, which is building Liberty motors, an 18 x 40-ft. room is equipped for training purposes with a lathe, a milling machine, a gear cutter, a drill press, a profiler and similar tools.

Only women 21 years of age or over are admitted. They are trained in the school for from one to three days. More than 50% of the first 500 had never been in a manufacturing establishment, but one day is found sufficient to remove the fear of the shop, according to a recent report to the section on industrial training for the war emergency of the Council of National Defense, from which these notes are taken. From its experience the company is of opinion that the vestibule school has come to stay and that eventually instruction will be given in this way to men as well as women. The training department of the Curtiss Aëroplane & Motor Corporation also gives employees preliminary training in mechanical operations and shop practice. Regular parts are made, and 100% inspection for quality is maintained. The school has a capacity of two hundred, and the time of instruction is from two to five days. An adjustment department is being developed to interchange labor, by means of the training department, from one department to another, without losing it. It has been found that when women have been introduced into mechanical activities without training, both employees and foreman are likely to become discouraged. If preliminary instruction is given, however, the employees are made adaptable to work for which they are fitted, and the company gets the help which it needs.

Large Freighters of Isherwood Framing Adapted to Bridge-Shop Fabrication

Problems Worked Out By Coöperation of Naval Architect and Engineer of Barge Shop—200 Tons Weight Saved—Time Gained in Detailing—All Molded Work Done in Large Shop at Shipyard

(Passed by Publication Approval Committee, Emergency Fleet Corporation)

STARTING out last July to build standard-type fabricated ships for the United States Steel Corporation, the Federal Shipbuilding Co., has developed specially efficient ship production through success in working out an economical shop-fabricated design and through coöperation with a bridge works that had been engaged in river-barge construction for a number of years. Utilizing the equipment and methods of the bridge shop, which were excellently adapted to the fabrication of straight parts of ships, the Federal company made a distinct saving in time. It was relieved of making a great many shop drawings and templets that otherwise would have had to be produced at the shipyard.

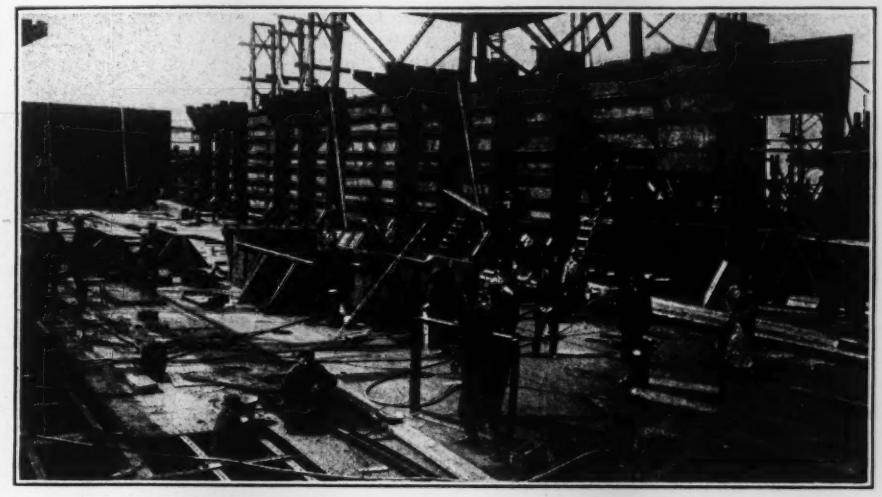


FIG. 1. INTERIOR VIEW OF HULL DURING ERECTION, SHOWING TYPE OF FRAMING AND SOME CHARACTERISTIC DETAILS

The same coöperation was of material influence on the adoption of the Isherwood type of framing. A saving of 200 tons of steel in the hull of the ship was accomplished through the adoption of this type, at first considered unsuitable for fabrication. This is a 7% reduction in hull weight, and means a saving of about $25,000 in the first cost of the ship; furthermore, the vessel can carry 200 tons more cargo for the same displacement.

The Federal yard, at Kearny, N. J., is building one of the largest types of ship under construction for the Emergency Fleet Corporation. Its dimensions are: Length 410½ ft. over all, and 395½ ft. between perpendiculars; molded breadth 55 ft.; molded depth 34 ft. 11 in. Its dead-weight carrying capacity is 9600 gross tons. For comparison, it may be stated that the Fleet Corporation's three agency yards are constructing vessels of 5000-ton (Submarine), 7500- and 8800-ton (Hog Island), and 9000-ton (Merchant) carrying capacity. Although these ships are materially smaller, the Kearny yard completed its first hull and launched it on June 19, well ahead of the earliest launching dates of Hog Island and Bristol, and less than three weeks after the first launching at the Submarine Boat Corporation's Newark Bay shipyard.

During the Government's indecision as to its ship program, last summer, when nothing was settled as to type of vessel, material or construction program, the United States Steel Corporation took up the construction of steel vessels on a large scale, using its own money, without waiting for Government action. It organized the Federal Shipbuilding Co. in July. Under direction of Robert McGregor, vice-president and general manager, the new company at once started developing plans for a yard, ship designs and production methods. Yard construction began in August. By that time the general lines of the ship had already been laid down. Soon afterward the projected ships were commandeered by the Emergency Fleet Corporation. The plant was planned and built as a permanent enterprise, to continue actively in shipbuilding, repair and dock service after the war emergency is overcome. Shipyard experience and precedent accordingly controlled the entire layout, though the fabricating procedure as well as the erection equipment, described in *Engineering News-Record* of June 13, p. 1129, was studied on the basis of bridge and structural-steel experience.

Ample shop facilities are the most striking feature of the plant, when compared with most other yards building fabricated ships. They find their explanation in the company's intention to do all its hull work in the yard shops, once the war emergency is over. Fabrication in distant bridge shops is used as a temporary expedient, to permit of turning out ships at maximum rate of speed. However, even now one-third of the entire hull fabrication is done at the yard.

The American Bridge Co. naturally became a part of the Federal company scheme, since both concerns are constituents of the United States Steel Corporation. The producing capacity of the bridge shops had to be depended upon to furnish the necessary steel for erection at the yard. The ten shipways at Kearny, if

crowded at greatest speed, may succeed in launching ships at as high a rate as 200,000 to 300,000 tons of hull weight per year. There was no time to wait until plate and angle shops of this great capacity could be equipped. The American Bridge Co. took up its part of the work without delay. It was well prepared through experience in similar work for a number of years before.

Barge building was made a specialty of the company's Ambridge, Penn., plant about twelve years ago. Launching ways and a plate shop to serve them were put in, and many steel freight barges, most of them now navigating the Ohio River and its tributaries, were built there. The shop force, the drafting room and the templet loft acquired experience in this special class of fabrication, and developed methods to suit. John L. Taylor, engineer of the barge department, sketches the development in the following brief statement:

"The company has been in the business of building steel barges for a dozen years. The vessels built range in size from cane punts, for export, about 20 ft. long and weighing a few hundred pounds, to car floats 308 ft. long and 50 ft. wide, weighing a thousand tons. For the first four or five years the steel-barge building was on a small scale, and regular structural shop methods proved satisfactory. As the volume of work began to increase, however, we found it expedient to abandon the practice of making detail drawings and bench templets, and began giving the templet loft only a general drawing and typical details to work to.

"Great care and forethought had to be used in both designing and detailing to permit as great a use of the multiple punch as possible, and in other ways to simplify construction, so that we might *manufacture* rather than *build* barges. The templet loft was skilled in adjusting the rivet spacing to suit multiple punching, and, as it also had to lay down the ship's lines and take off the various plates, frames and connections, it virtually became the equivalent of a shipyard mold loft and structural templet room combined.

"The barge-building experience gave us the necessary confidence to accept an order, some three years ago, for the parallel-body portion of a 400-ft. oil tanker. This was a vessel under construction by the Chester Shipbuilding Co., which, through the efforts of Capt. C. P. M. Jack, undertook to build several ships by the new procedure of getting all the straight parts punched and (so far as possible) riveted at a bridge shop, in order to reduce the shipyard work. Since that time we have furnished material for 13 other ships, before starting in on the Emergency Fleet Corporation work.

"There are only two differences between our barge and our ship work. The first is that the metal in the ship is much heavier than that used in the average barge, and slightly heavier than that used in our largest barges. The second difference is that in building barges we generally made our own designs, wrote our own specifications and used our own judgment in regard to rivet spacing and other details of construction, while in the case of a ship the design is furnished by the customer, and rivet spacing and details of construction are governed by the rules of a ship-classification society. Both design and details, therefore, required modification and adjustment in various ways to suit the shop tools.

"After these adjustments are made we find that a so-called fabricated ship is exactly the same as other steel construction. Moreover, it is identical with a built ship, except that (1) rivet spacing has to be juggled a little to permit the use of the multiple punch, and (2) the fabricating shop is 300 or 400 miles away from the building ways instead of 300 or 400 yards, which means that the design once made must be held to."

With an organization at the Ambridge barge shop ready to take up intensive fabrication of ship parts last summer, the Federal company was able to count on getting shopwork started without lost motion and having it continue at maximum speed. In the working out of design and production routine this fact was of marked influence.

Two Designs of Ship Compared Before Fixing on Type

Being organized to build vessels for regular trade service, the Federal company made its design accordingly. John C. Craven, the company's naval architect, states that it was decided to build ships for the South American trade, and the size was fixed at what practice showed to be suited to this service—about 10,000 tons carrying capacity. Many ships of approximately that size are now trading with South America, and several of these are of the Isherwood longitudinally framed type. Mr. Craven was convinced that a material saving of weight could be realized through adopting the Isherwood system.

However, it was learned that three barges of Isherwood framing had been built at Ambridge previously, and had proved troublesome. Hardly any two pieces were alike, and the work was excessively slow. It was felt that if the shop should find corresponding difficulty with Isherwood-frame ships, it would probably be better to use ordinary transverse framing, even though this weighed somewhat more. Two designs for the Federal

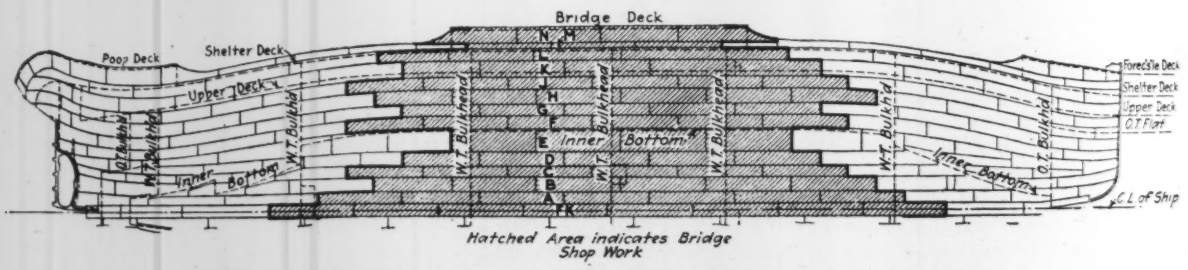


FIG. 2. SHELL EXPANSION; SHADED AREA SHOWS BRIDGE-SHOP WORK

ship were therefore worked out, one with transverse framing and one with Isherwood framing—the latter proving to be the lighter by 200 tons—and both designs were submitted to the bridge company for estimates.

Looked at from the shop's point of view, Mr. Taylor says, the Isherwood design at first appeared just as troublesome as the barges of the same system which had been built previously. Detailed study showed, however, that the anticipated difficulties either did not exist in the large ship or could be overcome by suitable detailing, especially as regards location of joints of the plating and rivet spacing. If anything, the fabrication appeared simpler than that for the transverse-framed ship. Much duplication of parts was feasible. The long frame spacing (10½ ft.) favored multiple punching, and reduced the amount of cutting and fitting in floor transverses and main frames. Above the double bottom, erection was simpler. On this favorable showing, the Isherwood design was adopted.

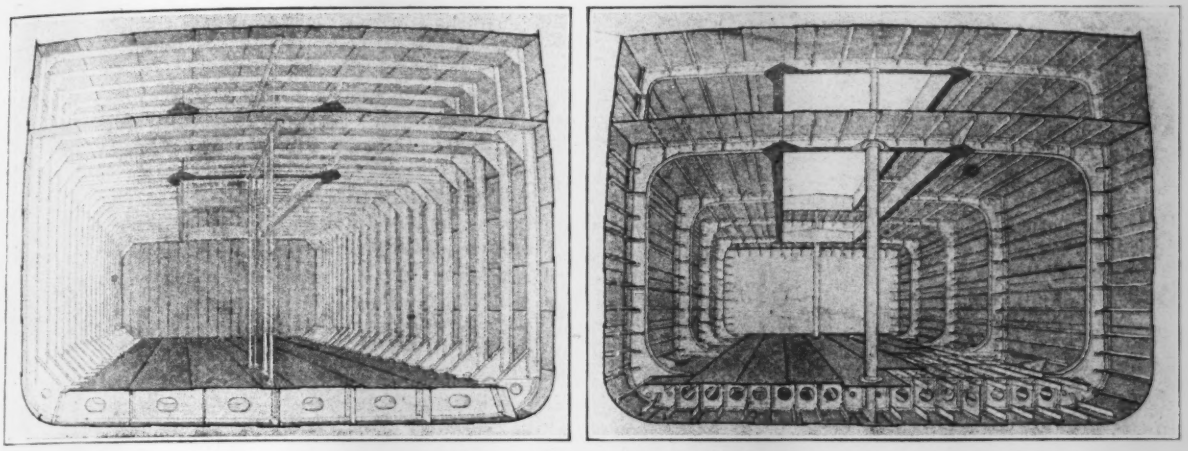


FIG. 3. DIAGRAMS OF TRANSVERSE FRAMING AND ISHERWOOD OR LONGITUDINAL FRAMING
[Sketches taken from a paper by J. W. Isherwood recently published in the *Journal* of the Society of Engineers]

The Federal ship has 40% of parallel length, which is stated to be about normal for slow freighters. While the shape of the ship was simplified somewhat in cross-section, Mr. Craven says that "not a single concession from the full requirements of navigability is contained in the design."

The mid-ship section was squared up by using no tumble-home and by making the bilge curve short (4-ft. radius). The outer bottom was given a 6-in. dead-rise from the keel, and the inner bottom was made parallel to it, so that the floors became a uniform depth, permitting them to be multiple-punched. The tank-top margins were carried out straight to the sides of the shell, to eliminate flanging and other difficulties of construction here, while drainage of the hold is provided for by the down slope to the keel. As to sheer and camber, the design is closer to shipbuilding custom than that of most of the emergency ships. The deck profile, while horizontal throughout the parallel-body portion, shows a curved sheer from here to the ends, rising 7½ ft. to the bow and 3 ft. 1 in. to the stern. The weather deck is fully cambered, with straight slope to the sides of the hatches and a curved middle portion. The main deck is flat transversely.

Multiple punching being counted on from the beginning as an important aid to rapid shop production and low cost, all shell plating, decks and bulkheads of rectangular outline were detailed to permit using the multiple punch. Careful study was given to simplication of the plating, in order to make as many plates as possible alike. In both respects considerable help was obtained through modifications of the ship-classification rules, permitting variations in rivet spacing and giving latitude in the spacing of the longitudinal frames. The seams (longitudinal splices) were made uniform in their relation to the longitudinal frame members, so that the "in" and the "out" plates of the shell have identically the same punching. The butts (transverse splices) were made uniform in rivet spacing and in their location with respect to the main transverses. As a result, in the shell of the parallel-body portion eight strakes of shell plating are alike on each side of the ship.

Simplification of rivet spacing to suit multiple punching was handled by the drafting room and templet loft of the bridge shop, which, as already explained, had experience in similar work. Drawings showing the layout of all the plating, and typical detail sheets showing the rivet-hole arrangement in the different classes of joints and connections, were prepared in the drafting room. The actual laying out of the rivet holes, however, was done in the templet loft, using the typical detail sheets and also following the modified ship-classification rules. The effect of the concessions permitting rivet spacing to be varied is thus explained by a shop representative:

"In the case of a typical shell plate, for example, three kinds of transverse spacing of rivets in addition to the marginal or seam spacing are found—at ordinary frames, at water-tight transverse members, and at butts. The spacing of the classification rules made it impossible to line up the punches of the multiple-punch gang to suit any two conditions exactly. However, with the concession as to rivet spacing, all three could be made to match. Irregular spacing was permitted provided that for every three or four rivets it would average the exact spacing called for by the rules. This enabled the templet loft to line up the butt spacing with the spacing at the ordinary frames, and locate the water-tight frame spacing be-

tween the two with no rivet distance less than 2 in., so that the individual punches of the gang could be set on the several holes."

The Federal Shipbuilding Co. has a smaller percentage of bridge-shop fabrication than any one of the three emergency yards. Only a little more than 60% of the fabricating work on the ship is done at the bridge shop

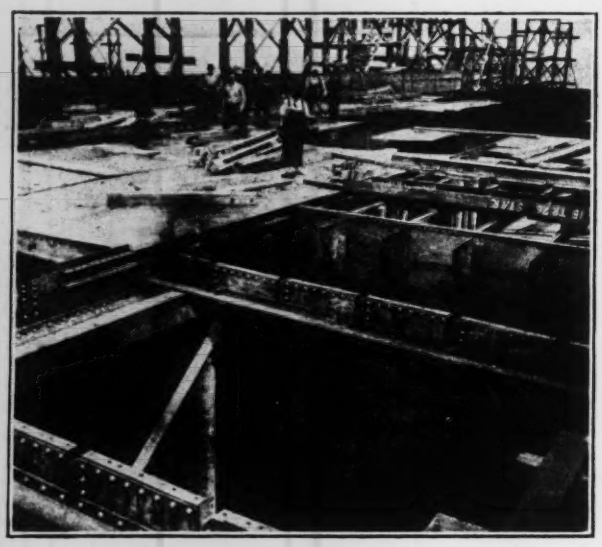


FIG. 4. FIRST OF THE FEDERAL SHIPS BUILT TO UPPER DECK LEVEL

(Fig. 2), and the other 35 to 40% is done at the Kearny yard, where a large and fully equipped shop has been set up. The decision to make such a division rested partly on the fact that the yard was to be built for permanent service, requiring a large shop in any event, and partly on the fact that the most efficient use of the existing bridge-shop facilities and organization was obtained by restricting the allotment to the parallel body of the shop. Bending and plate-rolling facilities as required for the shell plating and frames of the molded ends did not exist in any bridge shop, and thus had to be provided new, whether at bridge shop or shipyard. The same amount of time would be required in either case. It was believed that if the bridge shop were required to do both the straight work, which is similar to bridge and structural work, and the molded work, it could not manufacture as efficiently as if it did only the straight work.

Furthermore, the total tonnage of straight work which would be needed was sufficient to tax the spare capacity of the Ambridge plant, and probably of several other bridge plants in addition. In the circumstances, the molded work was allotted to the shipyard shop and a complete installation of the necessary machinery was made during the winter and spring.

The work done at the shipyard shop includes the punching and shearing of molded work as well as the bending. It was necessary to provide in the shop for ultimate equipment of punches and shears ample in capacity for extensive shipwork, and the required tools were available immediately through purchases of new equipment and machinery from a large shop just being dismantled.

Only two or three special operations involved in the ship work were found to be out of the ordinary for the Ambridge shop. The ship design called for scarfing—tapering off the shell plates to a chisel edge for forming a smooth overlap at the junction of three plates. As no scarfing is done in structural and bridge work, a machine had to be rigged up for the purpose. Two old vertical-spindle drills were set on a base plate, adjustably, so as to take the width of the plate horizontally between them and bring over each edge of the plate an inserted-tooth milling cutter mounted on the spindle. Wedge-shaped bearing blocks on the tables of the two machines carried up the end of the plate on the slope of 1 in 16, the standard slope of the scarfs. Provision was made for feeding the plate, with the bearing block on which it rested, across the table of the machine, thereby enabling the cutters to cut the two scarfs.

The rivet holes in the shell and deck plating of ships are countersunk. While bridges have few countersunk holes, the barge building required practically as much countersinking as ship work, and an efficient tool had been developed. This is handling the heavier work on the ship plating just as successfully. It is a portable electric drill, hung to the forward half of a small two-wheel buggy which the workman runs over the plate as it lies on the floor. The buggy frame is counterweighted at the rear, so as to tip the buggy back and lift the drill off the work except when the operator presses down on handles at the front end of the frame. Countersinking ⅞-in. rivet holes is done at the rate of about one in every five seconds.

The lightening holes in the floors, and the notches in the floors and transverses to pass the longitudinal frame channels, are punched out on a large manhole punch. Bulldozers, crimping presses and other regular bridge-shop tools do the small amount of bending, crimping, etc., required. The cylindrical bilge plates are rolled to curvature after being punched.

Design Details Simplified as Far as Possible

Joggling and scarfing were considered to be undesirable shop operations, but study of the saving of weight and other advantages secured through them resulted in the decision that both should be used quite extensively. In consequence, scarfing is used throughout the shell plating. It not only eliminates the dead weight of a beveled liner which otherwise would have to be used, and in addition the weight of material cut off in scarfing, but also keeps the rivet length at the triple lap down to two plate thicknesses, which make it easier to get tight work. In view of these advantages of scarfing, detailed cost comparisons between scarfing and beveled liners were not entered into; it was believed, however, that beveled liners would give much trouble in fitting, and so would involve expense not included in a comparison of direct costs.

With respect to joggling of frames and floors to follow the in-and-out shell plating, the decision was to use joggling rather generally as soon as the necessary presses could be installed, but to use parallel liners in place of joggling, in the first few ships.

The wide spacing of the main frames of the Isherwood system reduces the amount of joggling considerably. The channel longitudinals are set in and out to follow the shell plating, and require a filler only at butt splices in the plating.

About 600,000 rivets are contained in each ship. Only

8% of these are shop rivets, while 550,000 are field rivets. In general, only ¾- and ⅞-in. rivets are used. The middle body shell under strict reading of ship classification rules would require some 1-in. rivets, but it is detailed throughout with ⅞-in. rivets. The ends of the shell and the entire double bottom have ¾-in. rivets.

In punching, advantage has been taken of the accuracy of spacing secured through the multiple punch with automatic spacing table, to reduce reaming. For ⅞-in. rivets a ⅞-in. punch and a 1 3/16-in. die are used. This makes the hole slightly oversize, just enough to insure easy entrance of the rivet when the holes are perfectly true. The countersink, which works on the die side of the hole—all punching is done from the contact face or "faying surface" of the plates—is proportioned as for 1⅛-in. holes.

Snow Removed by Various Methods at Milwaukee

Street Railway Loads Snow by Electric Shovels into Dump-Car Trains and Motor Trucks Dumping Through a Bridge

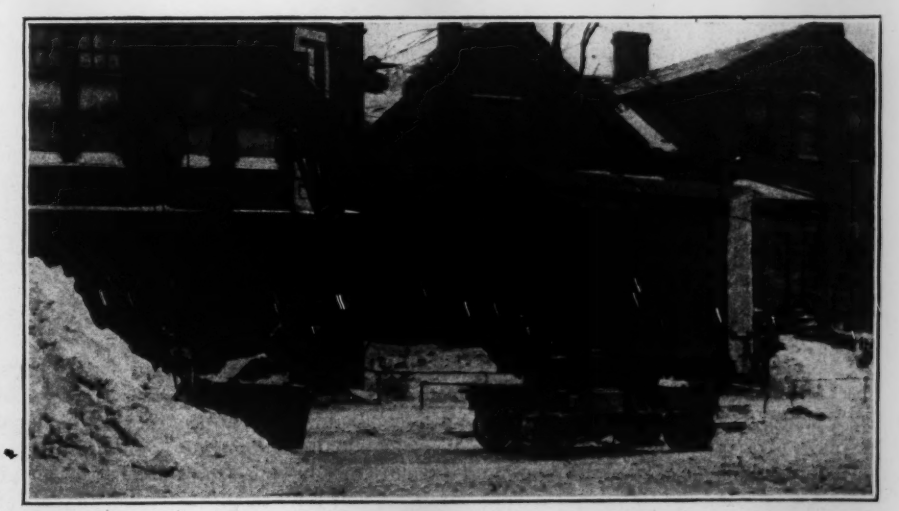
CLEARING snow from street-car tracks was an unusually difficult problem for the Milwaukee Electric Railway & Light Co. in January last, owing to the heavy storms. The snowfall for the month amounted approximately to 50 in., the heaviest storms being as follows: Jan. 1, 9 in.; Jan. 5, 19.7 in. (30.4-mile wind); Jan. 11, 10.5 in.; Jan. 26, 2.1 in. (25-mile wind); Jan. 28, 8.1 in. (31-mile wind). The weather was cold and the snow was dry, but the high winds caused heavy drifting and hard packing. Between the storms there were several days when high winds blew considerable amounts of snow back onto the tracks, so that a large part of it had to be handled more than once.

Rotary sweepers and nose plows attached to work cars cleared the greater part of the snow from the tracks. The company has 16 double-truck and 5 single-truck sweepers for city use, together with eight utility cars equipped with nose plows and 15 salt cars. The sweepers were always placed in service in the early stages of the storms, and by this means the lines were kept open so that even under the worst conditions there was no interruption of traffic on city lines. The mechanical equipment piles the snow on the sides of the street, just outside of the track zone. It is then leveled by means of heavy wings attached to the sides of the sweepers and work cars. In the heavy storms these piles became so high that they could not be leveled sufficiently to accommodate the traffic on the sides of the street, the entire space between the track zone and the curbs being occupied by the slopes of the piles. The company operates 403 miles of single track, with approximately 180 miles (or 90 miles of double track) inside the city limits. The amount of snow removed from the tracks in the city and piled on the sides of the street by the end of January amounted to more than

STREET RAILWAY USES ELECTRIC SHOVELS TO LOAD SNOW FROM STREET INTO DUMP CARS

1,500,000 cu.yd., as there were no thaws during the month. The company hired every available man, team and automobile truck, and put all of its work trains into service loading and hauling snow. The company forces loaded and removed the snow from all important street intersections and passenger landings, and gave substantial assistance to the city in removing snow from the sides of the streets.

Consent was obtained from the city to abandon one of the older drawbridges over the Milwaukee River, in the downtown district. Openings with trap doors were cut in the floor of this bridge, and practically all of the snow from the downtown district was hauled to the bridge by motor trucks and trains and dumped into the river through these openings. Two ⅜-yd. electric shovels which the company uses in excavating for track foundations were put in service. It was soon found that the capacity of the dippers was too small, and the ordinary method of moving on short sections of portable



ELECTRIC SHOVEL IS ADAPTED FOR LOADING SNOW BY SPECIAL 1½-YARD BUCKET AND HOME-MADE TRACTION WHEELS

track was not satisfactory. New reinforced sheet-metal dippers of approximately 1½-yd. capacity were designed and constructed in the company's shops, and improvised traction wheels were placed on the axles. After these changes much better progress was made.

The shovels were used in the business district to load the snow from the sides of the street onto trains of the company's small four-wheel dump-cars. It was necessary to close one track to traffic while this loading was in progress. More than 20,000 cu.yd. of snow was handled by these shovels. The output was limited by the ability to keep trains at the shovels, the principal difficulty being caused by traffic delays. The shovels were capable of loading 50 to 60 cu.yd. per hour, the dipper loads averaging about 1 yd. Hand loading of wagons and trucks by means of shovels averaged about 2½ cu.yd. of snow per hour per man.

Says Utilize Full Life of Light Railway Bridges

C. F. Loweth Decides Whether To Repair or Renew on Study of Limiting Unit Stresses and Loads for Old Structures

BRIDGES of light capacity which impose more or less restriction on the train loadings are found on most railways more than 25 years old, and it is an economic problem how to get full life and service out of such structures under the conditions of increased modern loading. This problem is of special importance at this time, when the supply of steel for new structures is so restricted that it is desirable to avoid renewals and replacements as far as possible. Special methods employed to ascertain the safe carrying capacity of old bridges were described at the convention of the American Railway Bridge and Building Association by C. F. Loweth, chief engineer of the Chicago, Milwaukee & St. Paul Ry. The following is an abstract of his paper:

Systematic investigation, or classification, as it is called, of all light-capacity bridges is made on the Chicago, Milwaukee & St. Paul Ry. in order to determine the maximum loads which can be carried safely. Every part of the structure is figured or taken into consideration. The carrying capacity is determined in terms of a standard series of loadings, and proposed new engine and car loadings are compared with these to show whether they can be carried safely.

Unit Stresses and Loadings

Maximum safe unit stresses to which the various materials can be subjected are first established. These are taken as near the limit of strength as is considered safe, but must be sufficiently low to preclude danger of the material failing in any way after being subjected continually to this limiting stress.

Safe limiting unit stresses may be taken as follows for structures of good design and in good condition: Beams and girders, fiber stress in bending, 22,000 lb. per square inch for wrought iron and 26,000 lb. for steel; truss members, tension on net section, 20 000 lb. and 24,000 lb. for iron and steel; timber stringers, 2000-lb. fiber stress in bending, with suitable reduction for exposed timber more than six or eight years old.

In fixing limiting unit stresses for loading old bridges, the following factors are taken into account: (1) Character of design and workmanship; (2) deterioration; (3) action under load; (4) probable speeds and observance of speed restrictions; (5) certainty as to the assumed loading being the maximum to which the bridge will be subjected; (6) importance of traffic and result of temporary disablement of the structure; (7) probability of early renewal, since a higher limit might be allowed for a short time to meet an emergency than for a structure to be kept in service indefinitely. Care and good judgment must be exercised in order to be on the safe side and at the same time conserve the maximum life of the structure.

For a unit loading, Cooper's series furnishes a convenient basis. Allowances must be made for impact, traction or longitudinal pull and centrifugal force on curves. Dead-load stresses and wind stresses must also be considered.

After the classification of the light bridges on various lines is completed, a tabulation is made of the load-limiting details of each bridge. Classification is made also of all engines, single and double headed, with appropriate train loadings; also of wrecking derricks and other heavy loads. Then a list is made of the loadings which may be permitted, with note of speed restrictions. This is issued in a form convenient for operating officers.

Where many bridges on one line require speed restrictions for certain loadings, it is generally desirable to rule off such loadings, as it is difficult to obtain the observance of a large number of speed restrictions. Double-heading of engines should be assumed, and special note made where it is not permitted. The schedule should also indicate the heaviest car loadings possible on the various lines.

Internal deterioration of the metal does not occur where a bridge has not been subjected to excessively high stress. Therefore, if bridges are not reduced in section by rust, and are not shaky on account of inadequate bracing, they are capable of carrying the figured loads at reasonable limiting unit stresses, provided they are carefully inspected and properly maintained.

Reinforcing Light Bridges

Strengthening of light bridges to adapt them to heavier loadings may consist of reinforcing minor details which limit the carrying capacity, or heavy reinforcing to increase the strength of the structure throughout. Minor strengthening can be done usually at small expense, and is an economical method of increasing the life considerably.

Heavy reinforcing may or may not be economical, as it involves expensive work in the field. Maintenance of traffic during the work is usually expensive, and involves some risk. On some large bridges, where the cost of replacing would be considerable, extensive strengthening operations have been carried out economically. In reinforcing bridges it is usually preferable to add new material, so that the structure is not temporarily weakened, rather than to remove parts and substitute heavier ones.

The cost of strengthening bridges varies with the

size of the job, the amount of staging required and its shifting on the work, the size of the crew needed and other factors. In general, the cutting out and replacing of rivets on such work costs from 25 to 75c. each; drilling and driving new rivets, 50c. to $1 each.

With old and light-capacity bridges, the question continually arises whether it is more economical to strengthen a structure or renew it. As a general proposition it would be permissible to spend each year for strengthening an amount equal to the interest on the investment in a new bridge, less the cost of additional maintenance required by the old bridge. For illustration, the accompanying table shows the cost of through spans designed for E-55 loading, replacing similar spans designed in the early nineties. New steelwork taken at 5c. per pound erected; falsework, $10 per linear foot; removing of old structure, $10 per ton; salvage on old spans, 2½c. per pound; additional cost of maintenance of the old span on account of additional inspection, classification and supervision, $1 per foot of span per year. The last column shows the amount which could be spent annually in strengthening old spans rather than in renewing them.

COST OF BRIDGE RENEWALS—CHICAGO, MILWAUKEE & ST. PAUL RAILWAY

Span, Ft.	New Steel Weight, Tons	Cost, Erected	Salvage	Net Cost	Interest on Net Cost at 5%	Available for Strengthening Each Year
50	33	$4,330	$1,130	$3,200	$160	$110
100	109	13,390	3,700	9,600	480	380
200	400	46,800	12,500	34,300	1,715	1,515
300	800	92,200	25,000	67,200	3,360	3,060

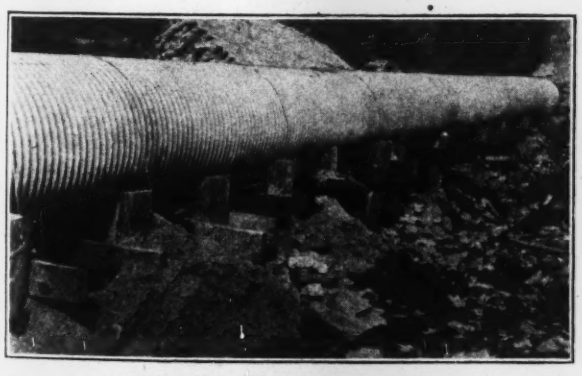
Renewal of a bridge having three 400-ft. spans, proposed about 10 years ago, would have cost about $370,000, after the salvage value of old spans had been deducted. Interest on this investment for the 10 years would have amounted to about $185,000. Instead of being replaced, however, these spans have been carefully maintained and inspected and the details strengthened wherever the classification showed that this was necessary to carry the heavier traffic. The actual cost of strengthening, together with the additional maintenance expense, has amounted to not more than $100,000 during this period, showing a saving for this one bridge of about $165,000 due to the policy of getting its longest practicable life.

With old and light bridges a limit is reached beyond which it is not economical to strengthen them, and replacement then becomes necessary. It must be recognized, of course, that a newly designed and heavy structure is preferable to a lighter structure. It is possible that in case of a serious accident on a bridge, a light structure might be destroyed while a heavy new structure might not be seriously disabled. Such considerations must be taken into account in shaping the general policy in keeping light bridges in service.

War-Time Repairs Form Basis of Future Sewer Reconstruction

By S. M. Bailey
Assistant Engineer, Department of Public Works, Newport, Ky.

During the winter of 1917-18 at Newport, Ky., a break occurred in the Washington Ave. egg-shaped brick 3-ft. 4-in. x 4-ft. 3½-in. trunk sewer, at about 120 ft. from the outlet into the Ohio River. The sewer at this place is in sandy soil, which is from 12 to 20 ft. deep under the invert and rests upon a layer of soapstone. After the break occurred in the sewer, high water and storm undermined and washed out the brickwork for 120 ft. and also the concrete outlet. This washout also caused an old masonry retaining wall, which had withstood numerous floods, to cave in and slide into the cut formed by water emptying from the broken sewer.



TEMPORARY PIPE WILL BE USED AS INNER FORM FOR PERMANENT CONCRETE SEWER

In the spring of 1918 it was necessary to make repairs at once, but because funds were limited only temporary construction could be undertaken. As the original break had been caused by the shifting of the sand overlying the soapstone, it was deemed necessary to drive piles through this soapstone. The outlet, consisting of about 20 cu.yd. of concrete, had been picked up and carried bodily down stream about 30 ft. For this reason the new outlet (35 cu.yd.) was built on 19 piles, at a distance of 160 ft. from the old brick sewer or 40 ft. further down the river bank.

Pile bents were then constructed on 4- and 8-ft. centers from the new outlet to the break in the brick sewer. The piles were driven 4 ft. through the soapstone. On top of these bents was placed 48-in. corrugated galvanized pipe in 14-ft. lengths securely bolted together.

At the outlet end the pipe was encased in the concrete, and at the brick sewer the connection was made by a brick manhole resting upon a foundation of six piles and 22.5 cu.yd. of concrete. Since the completion of the work there have been heavy rains, without any bad effect upon the construction. It is the intention next year to encase the corrugated pipe in concrete, using it as an inside form.

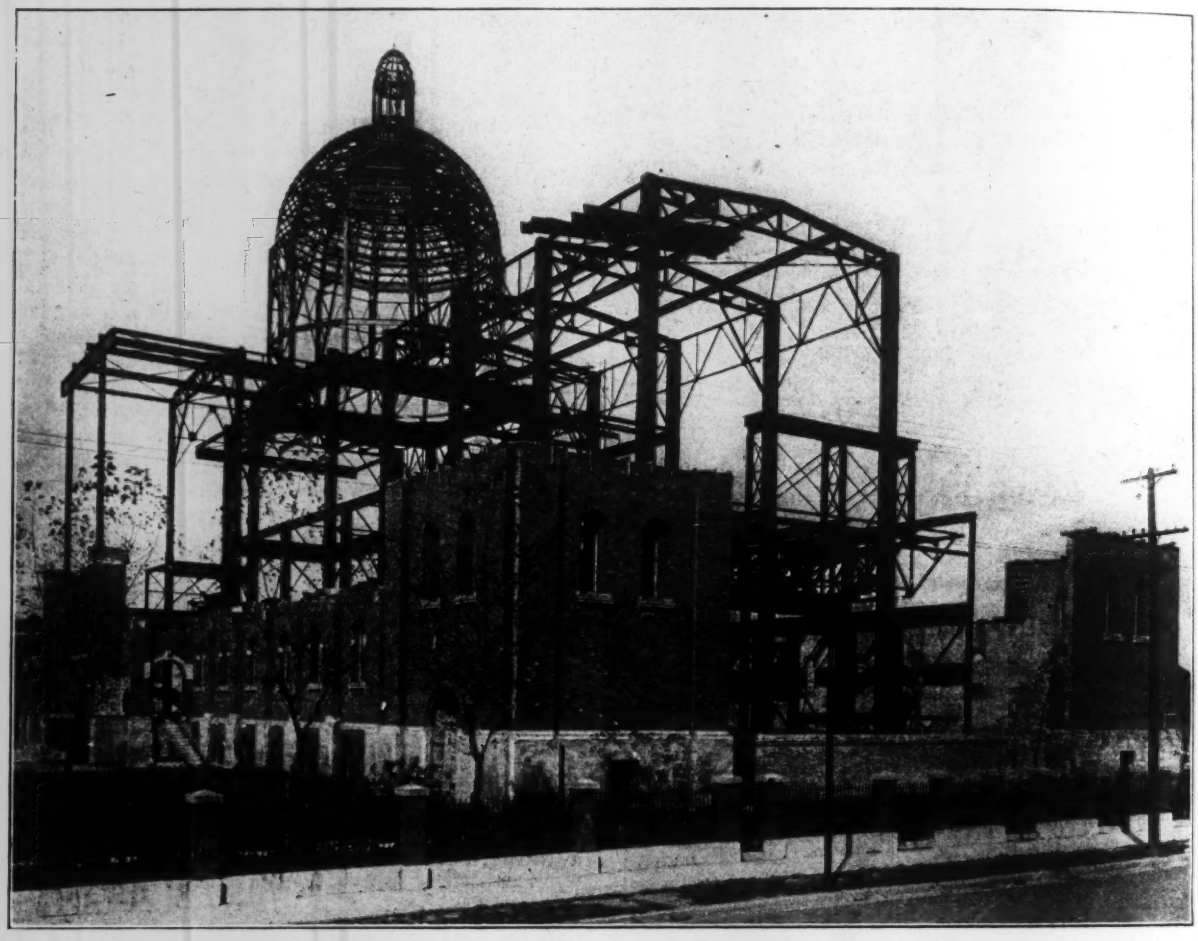
State and Districts Get Royalty on Sand

Kansas now collects a royalty of 10c. a ton on all sand taken from the beds of navigable streams. Part of the money goes to the natural drainage districts from which the sand is collected, and the remainder goes into the fund of the state water commission for use in drainage investigations. The first year under the new law, recently completed, yielded a total sum of $67,833 in royalties.

Steel Construction Characterizes Chicago Church

Cantilever Trusses Carry Front Wall and Gallery—Dome Trusses Are Supported By Girders On Tall Four-Post Tower Having No Interior Bracing

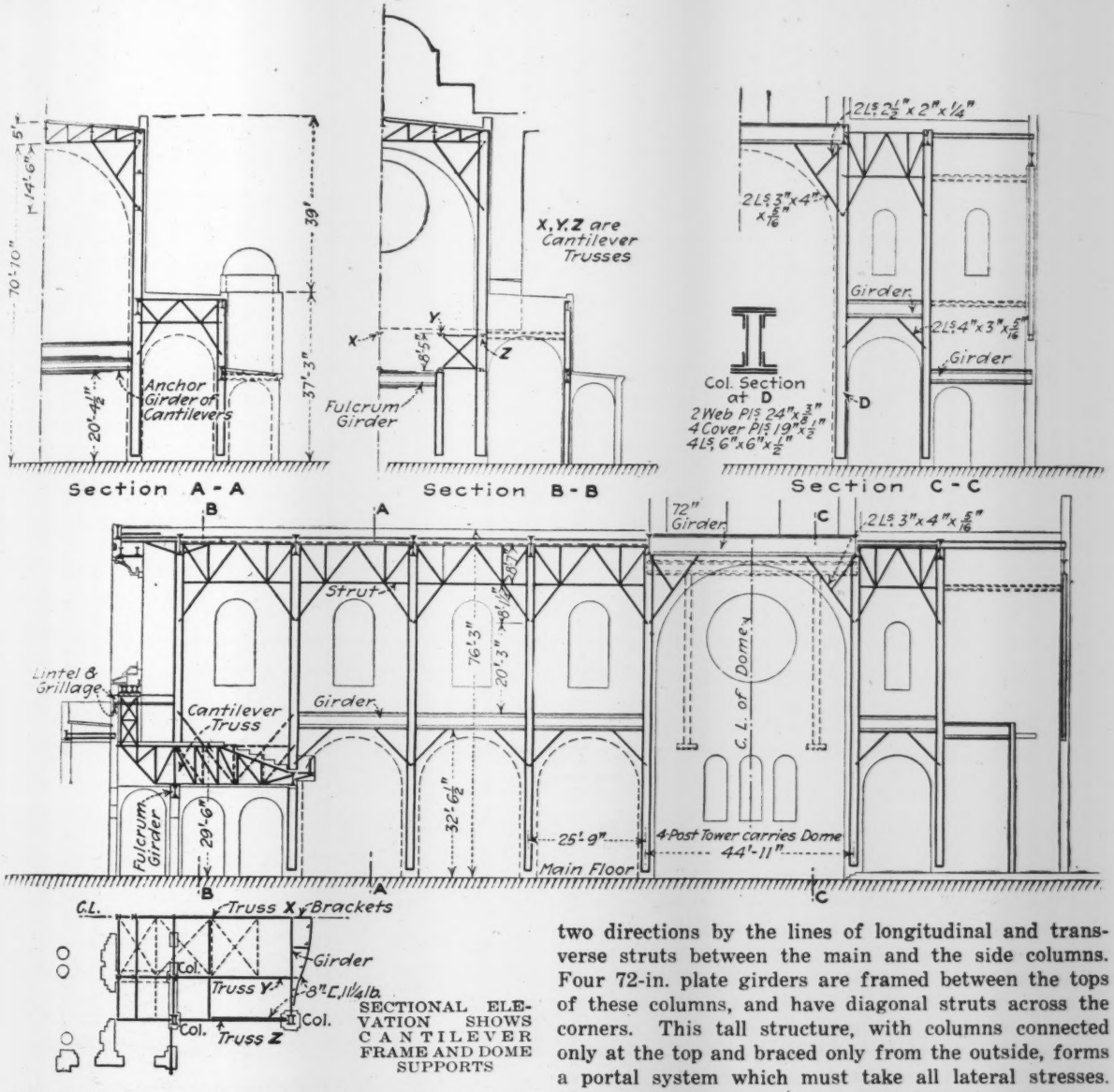
STRUCTURAL design of the church of St. Mary of the Angels, Chicago, is notable in that self-supporting steel-frame construction is used, independent of masonry walls, and that this framing includes cantilever trusses and a large dome. This church is cross-shaped, 215 ft. long, 100 ft. wide in the body and 124 ft. wide over the arms. The height is about 76 ft. under the main roof trusses and 35 ft. under the side roofs, while the top of the dome is 150 ft. above the floor.



STEEL FRAME OF CHURCH INCLUDES HIGH DOME AND CANTILEVER SUPPORTS FOR FRONT WALL

Cantilever support for the upper part of the masonry front wall forms the most striking feature in the structural design. In the original plans no supporting columns were provided for the front wall, as the entrance was to be left until the last. Masonry construction was begun in 1912 and carried on intermittently. When the roof design was undertaken, in 1916, it was not practicable to place the supporting columns, with necessary foundations, in the front wall, which was already erected for a portion of its height. A cantilever frame was designed, therefore, to carry the upper part of the wall, transmitting the load to the interior columns. It was utilized also to support the gallery within the end of the church. This frame spans the open space or lobby between the street entrance and the entrance to the body of the church. It carries a load of about 240 tons.

The design of this cantilever framework is shown in the drawings. There are five longitudinal trusses 38 ft. long and 8½ ft. deep, having a cantilever projection of 12 ft. Each outer truss is in two parts, one part being framed between two of the main columns of the church, and the other being a cantilever bracket beyond the outer column. The two inner trusses are continuous, their lower chords being seated on short columns which form their fulchrum bearings. Between these two columns is framed a transverse 36-in. plate girder which forms the fulcrum bearing for the middle truss, thus eliminating a central column and giving a clear space of 26 ft. for the main entrance. The rear ends of these three middle cantilever trusses are attached to a 30-in. anchor girder framed between the tall columns carrying the two outer cantilever trusses.



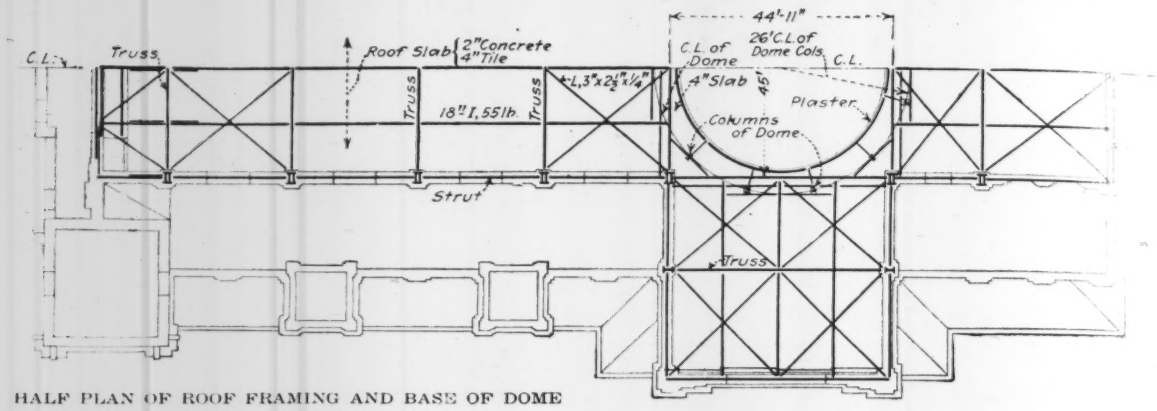
SECTIONAL ELEVATION SHOWS CANTILEVER FRAME AND DOME SUPPORTS

The truss system is fully braced, as shown. Sway frames are fitted between the trusses, while lines of struts are laid across their top and bottom chords, and diagonal bracing is riveted to the bottom chords. The rear portion of this frame being utilized to carry the end gallery inside the church, the three middle trusses have their top chords inclined to conform to the slope of the gallery floor. The outer trusses have parallel chords, but brackets on the posts carry inclined 8-in. channels which support the ends of the floor. This floor is built up of 2 in. of concrete and 5-in. hollow tile. A curved 8-in. channel carried by brackets on the face of the anchor girder forms the front of the gallery and is surmounted by a steel railing.

Four columns, about 70 ft. high, at the intersection of the main body and the arms of the church, form a tower supporting the dome. These columns are of heavy box section and are made especially rigid on account of the impossibility of putting bracing between them. Each column, however, is braced outwardly in two directions by the lines of longitudinal and transverse struts between the main and the side columns. Four 72-in. plate girders are framed between the tops of these columns, and have diagonal struts across the corners. This tall structure, with columns connected only at the top and braced only from the outside, forms a portal system which must take all lateral stresses. The weight of the dome, as carried by the girders, is about 720 tons.

The dome proper is hemispherical, with a radius of 30 ft. It rests upon a cylindrical base or tower 52 ft. in diameter and 30 ft. high, carried by the four 72-in. girders. Surmounting the dome is a lantern 18 ft. in diameter and 20 ft. high, making a total height of 150 ft. from the floor to the top of the steel work. The cylindrical tower has 12 columns of I-section seated on framing attached to the 72-in. girders. They are built up of 12-in. web plates and four angles, and are connected by ring braces of 15-in. I-beams and by struts between the heads of the columns.

Rib trusses of the dome are seated on these columns and have members built up of pairs of angles, as shown on the drawing. Across these ribs are laid purlins of T-section, some built up of pairs of angles and others being T-bars. An angle-iron ring 18 ft. in diameter connects the heads of the rib trusses and forms the seat for the twelve columns of the lantern. These in turn



HALF PLAN OF ROOF FRAMING AND BASE OF DOME

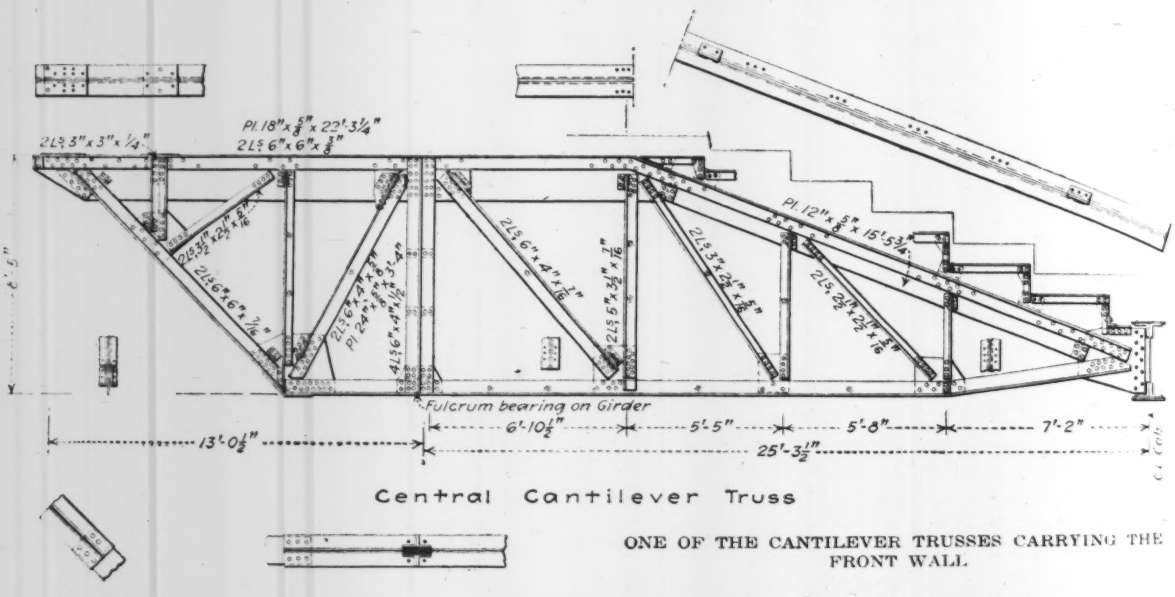
carry curved T-bar ribs which unite in an angle-iron top ring. Outside of the steel frame of the dome, with its base and lantern, is a 3-in. shell of concrete. A decorative exterior covering of terra cotta over a waterproofing layer of felt is used on the dome, while on its cylindrical base this covering is brick and terra cotta. The members of the steel skeleton frame are protected by a fireproofing casing of concrete and tile.

Steel framing for the main body of the church consists of four rows of columns having a longitudinal spacing of 25 ft. 9 in. Those of the middle row are of box section, almost 76 ft. high, spaced 45 ft. on centers and carrying shallow roof-trusses framed between them.

The outer or wall columns are about 30 feet high, with transverse girders framed between these and the main columns, to support the side roofs. Typical construction of the box columns consists of two 24-in. web plates, four outside angles and two or four cover plates 19 in. wide. The wall columns are of I-section, consisting in general of a 24-in. web plate and four flange angles. Struts and girders with truss bracing connect the columns and complete the structural framework.

Longitudinal bracing of the tall interior columns is provided by deep trusses framed between their tops; the bracing between the roof trusses also stiffens the structure longitudinally.. Except for the roof trusses, there is no transverse connection or bracing in the 45-ft. space between these tall columns. At the level of the lower side roofs the columns are braced longitudinally by a line of girders, and laterally by the transverse girders and struts of these roofs.

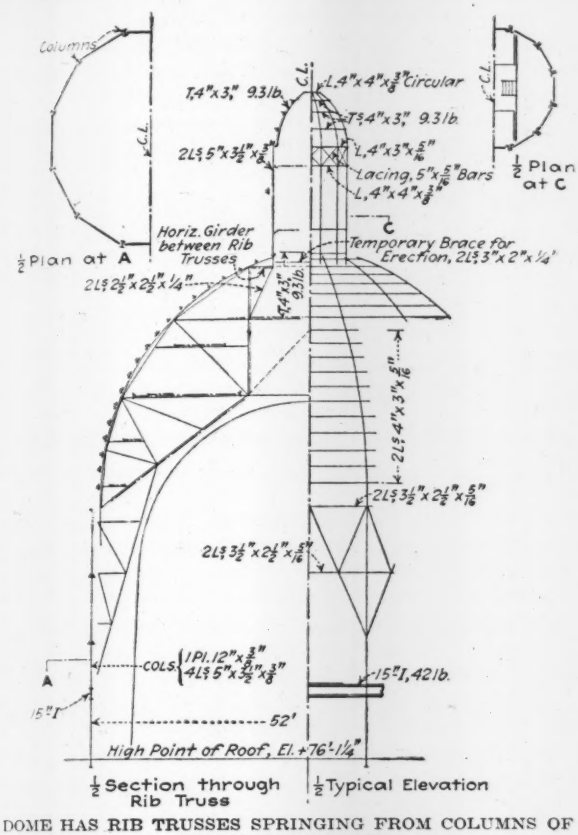
Concrete footings on piles form the foundations of the columns. Uplift on the two main columns to which the cantilever frame is anchored is taken care of by the weight of the clerestory walls, which are carried by plate girders to these columns.



ONE OF THE CANTILEVER TRUSSES CARRYING THE FRONT WALL

A roof of 2-in. concrete on 8-in hollow tile is supported by 18-in. I-beam purlins between the transverse trusses and girders, and is covered with a composition roofing. Brick walls form the sides and have stone and terra-cotta facing. Fireproof casing of tile and concrete protects the steel work. A decorative arched ceiling of plaster on steel lath conceals the roof framing. Similar decorative work is carried up inside the dome, with a false dome or ceiling suspended from the ribs, as indicated in the drawings.

Worthmann & Steinbach were the architects, while the structural steel design was prepared by the La Salle Engineering Co. Steel work in the foundations and



DOME HAS RIB TRUSSES SPRINGING FROM COLUMNS OF CYLINDRICAL BASE

basement was furnished by A. Bolter's Sons. That for the superstructure was furnished by the Hansell-Elcock Co. and Cerny, Pickas & Co., and was erected by the former. All the above are Chicago firms.

SOCIETY SERVICE

A Section Dealing with the Results of Teamwork by Technical Men

Ethics of Right Living Basis of Engineers' Code

Feeling that all codes for society adoption were of little value unless backed by moral obligation rather than disciplinary measures, the joint meeting last May of the American Association of Engineers and the Committee on Engineering Coöperation decided to put the writing of a code up to a committee of one, an individual engineer whose opinion was highly respected, and whose personal views would carry weight. The committee has recently completed what it calls "The Engineers' Creed." The American Association of Engineers printed the whole article in the November *Monad* and will distribute the essential portion in form for framing.

The subject is opened by establishing the fact that engineers are kin to the human family, and that "no man liveth unto himself." Since the discharge of that debt, which is a debt of honor, is the desire and effort of every honorable man, it is concluded that engineers need no more than the common every-day ethics of right living which are applicable to every vocation, calling or profession—"the honesty which is unswerving, the truthfulness which abhors a lie, the helpfulness which lightens the burdens of life, the human sympathy which gladdens aching hearts, the honor which scorns to take a mean advantage, the courage which always dares to do right, and the courtesy of kindliness."

As to the necessity of a code when each man carries in his own mind and heart rules of right living and honorable action, the committee states as follows: "It is, 'Lest we forget.' The law-abiding are not conscious of the restraints of the law, but the lawless are made to feel its power. A code of ethics accepted by the great body of professional men is the declaration of their faith, the chart by which they direct their course in the voyage of life. To this chart one who is in doubt may turn for suggestion as to the right course in any time of perplexity, and by the principles laid down in this chart transgressors will be judged and disciplined by their fellows."

The Code

"An engineer may not 'go beyond and defraud his brother' by any underhanded act or method. He may not do or say anything which will injure his brother's reputation or his business, for the purpose of securing his own advancement or profit. This admonition carries with it no obligation to refrain from telling known and absolute truth about an unworthy brother, as a protection to others, but the truth so told must be such as can be substantiated, and he who tells it must have the courage which will not shrink from the consequence of his telling.

"The engineer owes his client allegiance demanding his most conscientious service. But conscientious service to the client must never entail a surrender of personal convictions of truth and right.

"An engineer who receives compensation from an employer may not receive gift, commission, or remuneration of any kind from a third party with whom he does business for that employer.

"An engineer seeking to build up his business may not resort to self-laudation in advertising. He may state briefly the lines of work in which he has had experience and enumerate responsible positions which he has held and give his references.

"An engineer who employs others, either in his own service or in that of the client who employs him, should recognize in his relationship to them an obligation of exemplary conduct, of helpfulness and personal interest in those with whom he is thus brought in contact, and he should discharge such obligation tactfully and kindly.

"The honor of the profession should be dear to every engineer, and he should remember that his own character and conduct reflect honor, or the reverse, upon the profession.

"If, then, he so lives that his own honor shall never be smirched by his own act or omission, he will thus maintain the honor of the organization to which he belongs."

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Cleared Areas Measured with Planetable and Planimeter

Sir—In making monthly estimates of clearing and grubbing on a land-development project a method involving the use of planetable and planimeter was found eminently satisfactory.

The field work consisted simply of making a planetable survey of the clearing, obtaining all distances by stadia. It was generally possible to station the instrument in a commanding position, so that the rod could always be read when held at such points as were required to define the edge of the clearing. When two or more set-ups were necessary they were connected by stadia traverse. It was a matter of minutes to arrive at the area cleared by planimetering the map so made in the field.

The results derived by this method of measuring were of quite sufficient accuracy, inasmuch as monthly estimates were frankly understood to be approximate, the price per acre was the relatively low figure of $7.50, and the final estimate was based on the area of the field, previously obtained by a carefully chained survey.

Washington, D. C. EDWIN P. ARNESON.

Compensation of Engineers

Sir—I have read with interest the letter of "Engineer" in *Engineering News-Record* of Oct. 17, p. 729, and thoroughly agree with him that the engineers of the country should take the lead in the reconstruction work after the war, rather than bankers, lawyers, politicians or commercial men. As a matter of fact, all must work in harmony, and all the varied activities must be coördinated, in order to attain the maximum right results with a minimum expenditure of energy.

And certainly one of the first problems to be solved is that of labor questions and the relationship and partnership of labor and capital in our industrial and business enterprises.

Now, has the engineer shown himself capable of solving such problems? Has he kept step with the progress of the times? One criterion by which this will be judged is the concrete evidence of his relations with his own employees. How many engineers have taken account of the increased cost of living of their engineering employees? The writer recalls only one instance where the salaries of such employees have been automatically increased to take care of increased living expenses. Most increases are grudgingly granted, as if the employer were granting a favor instead of rendering just compensation for services received. Engineers have been so engrossed in reducing the cost of engineering work that they have failed to observe the cheapening effect of their attitude on their own profession.

There are many engineers and draftsmen now working for the same salaries as two or more years ago, despite added experience and largely increased expenses. Many a man with an expensive college education and five or ten years' experience is receiving less money than a man with a common-school education and two months' experience as a lathe hand. Yet all these engineers are expected to invest in War Savings Stamps and Liberty Bonds, and would be thought unpatriotic if they quit their work to go into other, better paying lines, for their work is very essential.

Again, it is a very common occurrence now for a skilled or semi-skilled laborer, or even a common laborer in some cases, to draw more money on a construction job than the resident engineer who holds his position by virtue of his ability to direct and supervise the entire work and accept the responsibility for its correct execution.

It would almost seem as if education were a handicap rather than an asset—and such viewpoint seems to be a common one among the boys and young men of the country. The future brains of the country are going into better paying lines of work, since the engineering profession at present offers to the great majority of those following it only a very mediocre living for much hard work.

How can the ordinary engineer devote much study and attention to community affairs when his time away from his place of employment is taken up with figuring problems in high finance, such as how to buy Jimmy a pair of shoes, Sally a coat, pay for a small portion of his winter's coal and get a much needed overcoat for himself, with less salary than a garage mechanic commands? How can an engineer receiving a "salary" of $150 per month expect to command the respect of a mechanic who is drawing "wages" of $60 to $100 per week?

This condition has not been caused by the war, although to a certain extent it has been exaggerated by war conditions.

Should not the engineer first reconstruct his own affairs before he attempts to reconstruct the affairs of others? AN EMPLOYED ENGINEER.

A Confusion of Sewage and Water Standards

Owing to momentary confusion of the well known standard of sewage dilution with the recently suggested standard of dilution to avoid burden on water-treatment plants, an error crept into both the article and the editorial relating to the report on pollution of boundary waters by the International Joint Commission, published in *Engineering News-Record* of Oct. 10. In the editorial on p. 653, it was stated that "the standard of dilution proposed by Professor Phelps as an equivalent to the tentative bacterial standard is the same as was devised nearly thirty years ago for Chicago by Rudolph Hering," etc. In the article mentioned, on p. 660, there appeared an extract from the report of the commission, stating that Professor Phelps had suggested a dilution of 4 cu.ft. per second per capita of population. In this statement there was inserted the editorial query, "4 cu.ft. per 1000?" This was an error.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Mnemonic Symbols Show Distribution of Construction Expenditures

ENGINEERING and construction expenditures on the Miami Valley flood-protection work are designated for distribution by mnemonic symbols. By a common-sense classification, and by subordinating the ideal of unlimited capacity for expansion, no symbol becomes unwieldy, although the number of features that are included in the system is large. Ordinarily, two numbers indicate the account, and in no case are more than two numbers and a letter employed, even for complex titles. Thus, No. 1-5 indicates expenditure for soil stripping at Germantown Dam, and No. 200-54b indicates expenditure for gasoline for automobiles employed in general headquarters service.

Construction of the Miami flood-protection work is separated into eleven construction features. Each of the detention dams counts as a feature, and the channel improvement is divided into six sections, each of which is designated as a feature. Each construction feature stands on the books as a separate permanent account. Numbers 1 to 99 are reserved for construction feature symbols. Feature numbers are also assigned to preliminary investigations and to general expense, because these are carried on the books as permanent features. To preliminary investigations is assigned the feature number 100 and to general expense the number 200.

Each feature account includes a number of item accounts. For the 11 construction features proper there are now 94 item accounts which are numbered 1 to 94, inclusive. Preliminary investigation has seven item accounts and general expenses 13 item accounts; these are numbered, respectively, from 101 to 107, and from 201 to 213. Obviously, additions can be made to these item enumerations if necessity arises.

It should be noted that the *feature* numbers in the accounting system are the same as the contract numbers, or job numbers, that have been assigned to each section of work from the beginning of construction plans. Similarly, the *item* numbers are the same in the accounting system as in the contract specifications, in the progress estimate sheets, etc. For example, backfilling, on any job, is item 38 and wherever backfilling is referred to, in the specification, on the drawings, in the schedule of unit prices, or in the accounting system, 38 is its classification number. For example, 4-38 is the account number for backfilling at Taylorsville, 2-38 for backfilling at Englewood, 5-38 for backfilling at Huffman—Taylorsville, Englewood and Huffman being job numbers 4, 2 and 5, respectively.

Besides feature and feature item accounts, provision is necessary for plant accounts and incidental operations accounts. Provision is made for 50 plant accounts and 50 incidental operations accounts. Plant accounts bear the numbers 01 to 050, inclusive, and incidental operations the numbers 051 to 099, inclusive. Item accounts for each plant or incidental operations account are designated by letters.

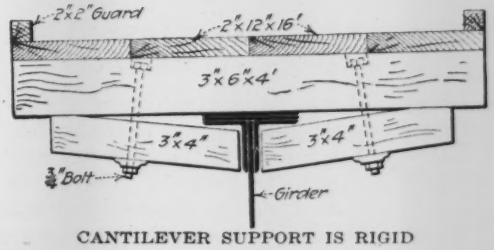
Combinations of the account numbers, briefly stated, designate the distribution of every expenditure. These combinations are simple, as a few illustrations demonstrate: Let it be required to designate expenditure for class 1 excavation for the outlet works for the Englewood Dam. The Englewood Dam has the feature number 2; outlet excavation class 1 has the item number 13; then No. 2-13 designates the account to which the expenditure will be distributed. Again, let it be required to designate expenditure for dismantling dragline excavators working on the Englewood Dam. As stated, the feature number for Englewood Dam is 2. The plant account number for excavating plant is 04; the plant account item letter for dismantling excavating plant is P; therefore No. 2-04P designates expenditure for dismantling excavating plant working on Englewood Dam.

Blueprint schedules furnish all who have occasion for them with lists of the accounts and their designating symbols. Those using them constantly have most of the symbols memorized. The account number scheme is part of the accounting system worked out under the direction of Charles H. Paul, assistant chief engineer, Miami Conservancy District, aided by F. L. Cavis, consulting accountant.

Cantilever Runways Carried on Central Girder Quickly Moved

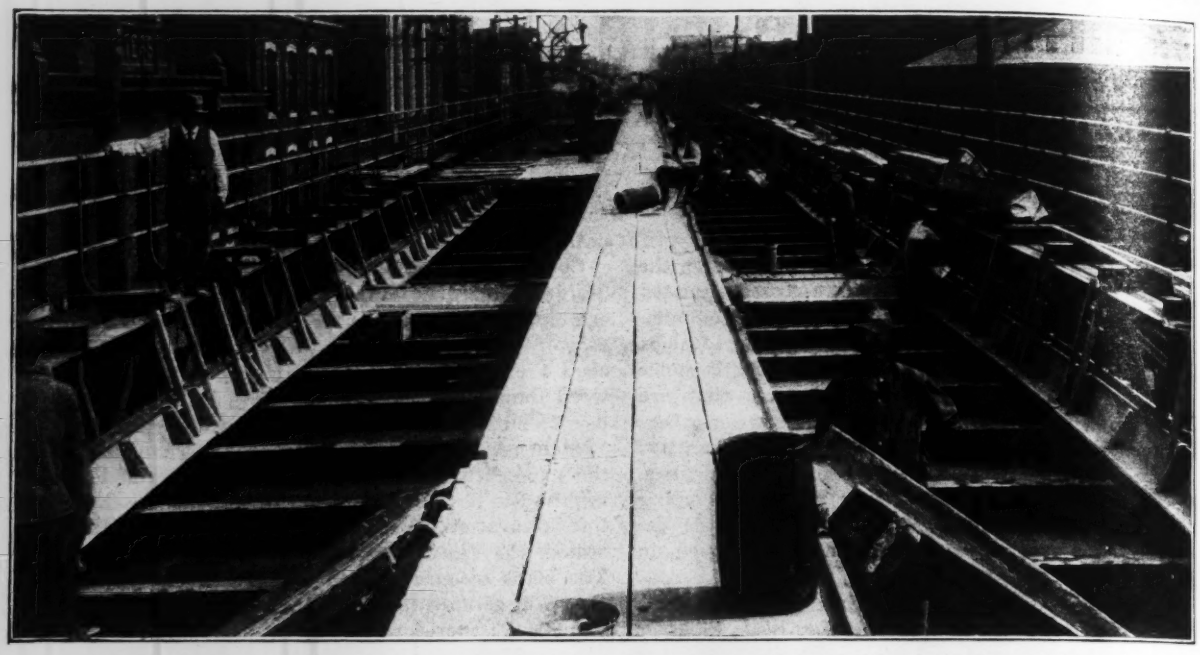
CANTILEVER runway sections which are perfectly solid, but which can be taken down by the removal of a few bolts and moved ahead quickly, were designed by the Union Paving Co. to fit the central longitudinal girder of the Frankford elevated line, Philadelphia. The company is concreting the deck of the elevated line.

There was no room to put runways on the floor of the structure without interfering with the concrete work,



CANTILEVER SUPPORT IS RIGID

and the walkway on the outside girder was not wide enough for the purpose. To build a runway which would have fitted around the brackets of this walkway would have been a big job, while at first sight to build



RUNWAYS PASSING SIDINGS AND CHUTES CARRIED CLEAR OF FORMS ON CENTRAL GIRDER

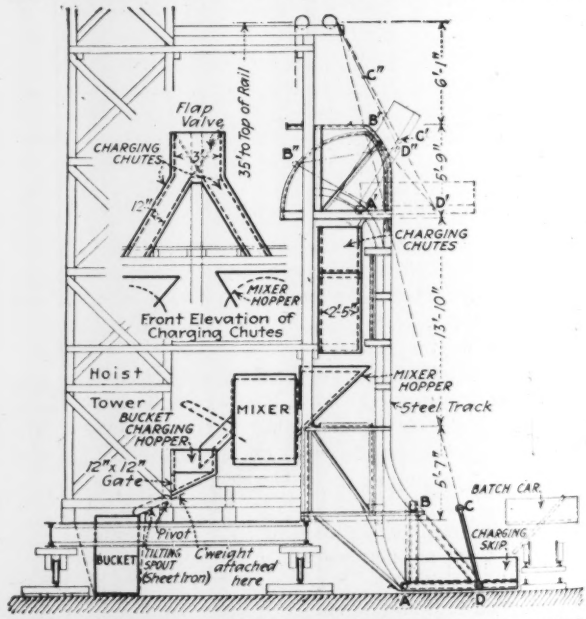
a wide runway on the central girder would also have required a lot of carpenter work every time the sections were moved. This, however, was overcome simply and easily by resting the runway sections directly on the flange of the girder and bolting to the 3 x 6 battens a 3 x 4 on each side of the girder. The 3 x 4 was drawn up tight by a single bolt under the flange of the girder and bearing under the batten a few inches from its outer end. The sections are 16 ft. long, each made up of four 2 x 12-in. planks resting on three of the battens. A 2 x 2-in. guard strip is nailed along each side at the edge.

Where a passing is required, the extra width of planking is supported on joists across to one of the outside girders.

A useful feature of the scheme is the method in which the bolts are put on. They cannot be lost in moving because the heads are counterbored under the decking in the 3 x 6, and the nuts and washers can be screwed on again after the short blocks underneath have been taken off.

Twin Mixers on Traveling Tower Charged Alternately by Forked Chute

BATCH handling was entirely mechanical and largely automatic from charging skip to tower bucket, and thence to chutes to forms, in the traveling mixing plant for concreting the new water-works reservoir at St. Paul, Minn. Cars coming from storage bins brought proportioned buckets and dumped into a charging skip. This skip, a rectangular box open at the top, was hoisted 25 ft. and dumped automatically, occupying successively the positions from A B C D to A′ B′ C′ D′, and finally to A′ B″ C″ D″, as shown in the illustration. A forked charging chute, with a flap valve, received the batches from the skip and delivered them right and left alternately to the ¾-cu.yd. mixers. Of the succeeding batch-handling mechanism only the bucket-charging hopper was unusual. This was a narrow box, long enough to embrace the hinged emptying chutes of both mixers and having its bottom inclined three ways to a discharge gate at mid-length. A tilting spout formed the link between the discharge gate and the hoist



SINGLE CHARGING SKIP DELIVERS ALTERNATE BATCHES TO TWIN MIXERS

bucket. On the drawing the batch-handling mechanism is depicted by heavy lines. The traveling mixer was a part of the plant of the George J. Grant Construction Co., St. Paul, Minn., contractors for the construction of the reservoir.

NEWS OF THE WEEK

New York, November 7, 1918

No Let-Up in Shipbuilding After Peace Comes

Hurley and Schwab Issue Statements Showing 83 Per Cent of Program Yet to Be Completed

That shipbuilding operations would continue on a tremendous scale, without let-up, after peace comes, since 83% of the shipping program is yet to be carried out, is the substance of statements issued Nov. 1 to the workers in the shipyards by Edward N. Hurley, chairman of the United States Shipping Board and Charles M. Schwab, director general of the Emergency Fleet Corporation.

In part, Mr. Hurley's statement follows:

"I wish to reassure and encourage the men in American shipyards, who may fear that their efforts to provide an emergency fleet are limited by the necessities of war.

"The project to build the fleet was conceived in the emergency of war, but it has never been intended, nor is it intended now, that this great movement shall cease when the war is ended.

"We are only now beginning our program of ship construction. The removal of the emergency cannot and will not bring an end to the world's need for ships, nor prevent us from carrying out our program to a successful conclusion. We shall continue to use all the facilities of shipbuilding that business economy will permit.

"I mean by that that all shipbuilders who live up to the expectations placed in them by the Government will be expected to continue to build ships. They will be encouraged to do so. There will be plenty of work for every efficient yard.

"On the other hand, the Government expects to continue to supply the material and direct the vast energies now devoted to shipbuilding. The end of the war will mean only the removal of the menace which confronted the world's shipping; it will not and cannot mean the immediate elimination of the need for ships.

"The ships must and will be built. The work which the inefficient yards cannot do will fall to other plants. We will look to the West coast to continue the pace it has maintained and to the yards in the East and South and in the Great Lakes region to increase their output.

"So I can say with frankness that our shipyards will be kept going to their capacity and they must not let up. The inefficient plants which have been permitted to operate because of the

(Concluded on page 868)

Reconstruction Commission Bills Introduced in Congress

Weeks and Overman Measures Before Senate—Participation of Business Men a Main Issue

By Wingrove Bathon
Washington Representative of Engineering News-Record

A great fight is about to be staged in Congress, according to the view of well informed Washingtonians, based upon what character of reconstruction commission or agency shall be intrusted with the work of guiding American industry during the period after the war.

Two important bills have been introduced in Congress dealing with this subject. One is a bill by Senator John W. Weeks of Massachusetts, the other a bill by Senator Lee S. Overman of North Carolina. The bill introduced by Senator Weeks, which is in fact a proposed concurrent resolution of Congress, would provide for a Congressional committee on reconstruction, to consist of three senators to be named by the Democratic senatorial caucus; three senators to be named by the Republican senatorial conference; three representatives to be named by the House Democratic caucus and three representatives to be named by the Republican House conference.

No provision is made in Senator Weeks' plan for appointing business men in private life to his proposed reconstruction agency. On the other hand, Senator Overman's bill would establish a Federal Commission on Reconstruction, to be composed of five commissioners, who shall be appointed by the President of the United States. The plan of Senator Overman is known in Washington as the administration plan and is said to have the sanction of President Wilson. Senator Overman's plan, also, it is understood, contemplates the appointment by the President of business men in private life as commissioners, who shall have the authority to employ and consult economists, investigators, special experts, etc., and $500,000 is appropriated to carry out its provisions. In this respect, Senator Overman's plan follows the line of suggestions made by the Washington representative of *Engineering News-Record* in these columns last spring.

Both measures specify the character of the investigations to be made—namely, problems affecting labor; capital and credit; public utilities; the results of the demobilization of industrial and military war resources; foreign trade; the condition of existing industries and the establishing of new industries; agriculture; adequate production and effective distribution of coal, gasoline and other fuels; shipping, including shipyards and the sale, continuance of ownership or leasing of yards and ships; housing conditions and the disposition of houses constructed by the Government; war legislation now on the statute books; technical education and industrial research; the organization of Government departments with a view to putting the Government on an economic and efficient peace basis, etc.

It is pointed out in Washington that Senator Weeks' proposal would place any reconstruction agency formed under his bill in the hands and in control of Congress and that, by reason of the manner in which his proposed reconstruction committee is to be named, it would be difficult, if not impossible, in many cases, to have questions decided upon a basis other than their political merits.

Senator Overman's proposal, on the other hand, contemplates the appointment of business men, who might be expected to treat from a business point of view the problems coming before them.

Los Angeles Plans Harbor Improvements

Bulkhead construction, dredging and land reclamation are included in projects for new shipping and terminal facilities at Los Angeles, Cal. The city's Harbor Department has two proposals planned. One of these is the construction of a rock bulkhead or seawall extending east from the present fish harbor seawall and about 3000 ft. south from the shore of Terminal Island. This will retain a fill of material dredged in widening the main channel. The Harbor Department operates its own quarry on Catalina Island, 18 miles distant, and will spend about $10,000 per month in building this seawall. It is not intended to rush the work any more than is necessary to hold the fill, but eventually this seawall will be extended to the eastern city boundary, about 1¼ miles. The seawall work consists of timber and earth bulkheads on the east and west sides of the west basin, to hold material dredged from the basin.

Three dredging projects are to be

carried out by the United States Government, and appropriations for these have been made. At the west basin a 200-ft. channel, 4800 ft. long and 30 ft. deep, will be dredged westward, at a cost of about $204,000, to provide access to a dry dock which is to be built by the Los Angeles Shipbuilding & Dry Dock Co. For widening the present 500-ft. main channel to a minimum width of 1000 ft., with 30 ft. of water, there is available $150,000. The total estimated cost is $626,000. For dredging the west end of a channel extending eastward to connect with the harbor of Long Beach, there is an appropriation of $130,000. This channel will be 200 ft. wide and 20 ft. deep, and beyond the city limits of Los Angeles it will be dredged by the city of Long Beach.

Grain elevators, coal bunkers, tanks for the vegetable-oil trade, new wharves and sheds, and freight-handling equipment, are among the improvements recommended in the recent annual report of Clarence H. Matson, traffic manager of the Harbor Department. A proposed railway to connect the Atchison, Topeka & Santa Fé Ry. with the municipal terminal railway is not to be built now, as, with Government ownership, all railways can use the existing connection. Mr. Matson states that one result of the $5,500,000 spent by the city on its harbor in the past seven years is that shipbuilding to the value of more than $100,000,000 is now in progress, employing more than 14,000 men.

First Meeting of Development Committee Postponed

The meeting of the Committee on Development of the American Society of Civil Engineers, which was scheduled for Oct. 31 in Chicago, has been postponed to Nov. 14. This will defer the preliminary report of the committee, which was expected Nov. 1. A review of the proposed scope of the work and the program of the committee appeared in *Engineering News-Record* of Oct. 10, p. 658.

Intercity Viaduct Finally Bought by the Two Kansas Cities

Long negotiations for the purchase of the Intercity Viaduct over the Missouri River valley by Kansas City, Mo., and Kansas City, Kan., came to a conclusion by the final signing of a purchase contract on Oct. 24. The last offer of the bondholders in the viaduct company was a price of $1,750,000, and this offer was accepted. Kansas City, Mo., will pay 56% of the amount and its Kansas neighbor 44%. Municipal bonds at 4½%, redeemable in five to 30 years, will pay for the viaduct. Ratification of the bond issues by general vote is necessary to make the purchase finally effective, but little doubt is entertained concerning the outcome. In the meantime, the cities will take over the structure and throw it open to free use.

Brooklyn Rapid Transit Wreck Kills Eighty-Nine

Five-Car Train Run by Substitute Motorman During Strike Jumps Track at Tunnel Portal

Eighty-nine persons were killed and a greater number injured Nov. 1 when a five-car train on the Brighton Beach line of the Brooklyn Rapid Transit Co., New York, was derailed and crashed into the supporting structure of a tunnel at Malbone St., Brooklyn. Because of some construction work under way a sharp reverse curve had been installed at the entrance to the tunnel. The train, striking this curve at high speed, jumped the track, struck a concrete pier at the portal, and continued for some distance into the tunnel, striking a number of columns before coming to a stop. The accident occurred in the evening rush hour, and the cars were crowded. Several of them were old wooden cars and were virtually demolished, few if any of their occupants escaping death or serious injury. There was a down grade to the tunnel, and the motorman is quoted as saying the brakes failed.

A strike had been inaugurated that morning. The company had some time previously discharged a number of employees who had joined the Brotherhood of Locomotive Engineers. Denying its men the right to join this union, the company had tried to persuade them to join instead an association of employees within the company itself. The employees had appealed to the War Labor Board, which on Oct. 28 had handed down a ruling that the men had the right to join the union, and that 29 of those discharged were to be reinstated; the company could refuse to deal with the union, but the procedure of the association of employees should be modified. The company interpreted the order as permitting it to refer the question of reinstatement to the association. The employees interpreted it otherwise, and the strike was ordered.

A dispatcher pressed into service as a motorman was running the train that was wrecked. How much experience he had had as a motorman is under dispute. Some assert that he had had little or none; the president of the company denies this. It is not denied that he had done a day's work as dispatcher before taking the train, and that he was tired.

The motorman and two other employees have been held. Mayor John F. Hylan has instituted proceedings to fix the responsibility. The strikers returned to work the day after the accident.

Niagara Power Companies Consolidate

The Niagara Falls Power Co., the Cliff Electrical Distributing Co., and the Hydraulic Power Co. of Niagara Falls, have been consolidated by agreement effective Oct. 31, under the name The Niagara Falls Power Company.

Irrigation and Dry-[illegible]ng Associations Mer[illegible]

The International Irri[illegible] Congress and the International [illegible] Farming Congress were perma[illegible] consolidated as the Internat[illegible] Farm Congress at the meeting O[illegible] held in Kansas City, Mo., men[illegible]ed in *Engineering News-Record* of [illegible]t. 10, p. 687.

No Let-Up in Shipbuilding

(Concluded from page 867)

war emergency and the immediate need of ships, will, as a matter of business expediency, drop out when the emergency is removed. Efficient yards will be encouraged and supported, because we can depend upon them to carry out their promises and produce ships economically. In this way, we shall be able to compete in the markets of the world with our ships on a price per ton basis, as compared with the ships of other countries.

"The demand for the expert worker will be greater than ever, because the large part of the task of completing our program of ship construction is still before us. More riveters, shipfitters, chippers, calkers, bolters-up, riggers and draftsmen, foremen and executives will be needed after the war.

"There is no ground for any uneasiness of either labor or capital now efficiently employed in producing ships. For many years to come ships, their construction and operation, are to be of absorbing national interest."

At the same time Mr. Schwab pointed out that, while the present program calls for 15,000,000 tons of merchant ships, representing something like 3000 vessels, there have been built only 2,500,000 tons, and the work would therefore not be completed until five times more work had been done. Portions of Mr. Schwab's statement follow:

"Until peace is concluded and until all of our boys have returned to America, it is vital that we keep on building ships with every ounce of our strength and energy. After that we can consider the future. But to permit enthusiasm to lag now might be fatal to our great cause.

"Shipbuilding, from the very start of the war, has been the essential work that would make victory possible.

"Even when peace comes, if it comes within the next year, you will not have completed the job that America set for you. Chairman Hurley of the United States Shipping Board has pointed out the shipping needs of the future. He has studied this question and is competent to speak as an indisputable authority.

"Now, Mr. Hurley says that it is wrong to assume that when peace comes again and the war needs for ships have been met, our great new shipyards will have nothing to do. This is a mistaken assumption. If peace comes soon, we shall not be anywhere near the end of this shipbuilding job—only at the beginning."

Shipping Board Curtails Camden Yard Extension

Radical Change in Troop Transport Requirements the Cause—Parallel to Alameda Case

Further action on the shipbuilding program was announced by the United States Shipping Board Oct. 31. Following the revocation of the contract for the new Alameda yard reported in these columns last week, the decision was reached that the extension of the New York Shipbuilding Corporation yard at Camden, to provide increased capacity for building large transports, should be very much reduced. Details of the curtailment were left to the Emergency Fleet Corporation.

Last April the War Department called on the Emergency Fleet Corporation for the construction of 94 transports of about 12,000 tons each. The troop-ship program at that time in progress was but a little more than half the total tonnage of the Emergency Fleet Corporation work. As existing yards did not appear to have sufficient capacity, two new yards were at once put under construction, an extension of the Camden plant of the New York Shipbuilding Corporation and a new plant adjacent to the Bethlehem Shipbuilding Co.'s yard at Alameda, Cal. The vessels turned out by these yards would not be available for service until 1920, it is stated, and because of the acceleration of the troop-moving program by the War Department during the past year they no longer are important to the prosecution of the war program.

Motor-Truck Parcel-Post Service Proving Successful

Reduction in the cost of milk to consumers from 17c. per quart to 10c. per quart, and the development of a revenue of $16,000 monthly during the eight-month operation of a truck route out of Washington, D. C., are reported by James I. Blakeslee, fourth assistant postmaster general. Seventy lines of motor-truck mail routes have been established and are in operation in the country. All but one of these are east of the Mississippi River.

In giving the above information, Mr. Blakeslee suggested a use for the damaged motor trucks at the battlefront which are of no further use to the Army. These could be sent home, repaired and used in the parcel-post service.

The great advantage of this system of picking up mail and parcel-post matter through the country districts was brought out by a definite incident where milk, which is selling for 17c. a quart in the city of Washington, is being picked up by the mail service and transported directly to the consumer in the city, for 10c. The great expansion possible for the service is shown by the development of a truck route between Washington and Philadelphia, which in eight months has developed a revenue of $16,000 per month, as stated above. Another truck route which started with a monthly business of only 28 parcels now shows a ton of traffic each day.

Experience has shown that operating at night is the most profitable, according to Mr. Blakeslee, and that the typical length of route is about 180 miles, or 90 miles out and 90 miles back. It has also been found that constant operation of the lines produces in a short time a return load, the universal character of the mail service allowing almost anything to be taken, in any kind of weather.

Mr. Blakeslee pointed out that a prime necessity for the service is good roads. If these can be obtained 9000 trucks can easily be used for this service in the country, and possibly as great a number as 66,000. The program indicated for the future seems, he thinks, to be the use of airplanes for the 1000-mile distances, trains for 500 miles, and trucks for 250 miles.

Recruit Men for Army Motor Transport Corps

Highways Transport Committee Assigned Task—Plan Replacing Men in Civil Positions by Women

Assisting in the recruiting of men for the Motor Transport Corps of the Army is the task assigned to the Highways Transport Committee, Council of National Defense, by Gen. C. B. Drake, chief of the Motor Transport Corps. Among the suggestions offered for increasing the supply of men for this service is one which involves the substitution of women for men in civil positions. The training of men whose age makes them unavailable for Army service is also proposed. The approximate size of the force to be recruited is 200,000, with an equipment, beyond that now in the service, to the value of $130,000,000.

In carrying out the above assignment, the Highways Transport Committee will have opportunity to utilize its organization, including the regional directors, the committees organized in its behalf by the state Councils of Defense throughout the country, and their local committees.

In order to prevent the disruption which would follow if tens of thousands of skilled men were taken away from the great organizations engaged in operating and maintaining the industrial transport service of the country, and at the same time to provide an adequate force, it will be necessary to work out some plan to obtain substitutes for those taken away. The training of men too old for Army service and the substitution of women for men in driving motor trucks for industrial service are suggested as means of increasing the available supply. The plan will be carried out on the basis of considering these recruits as volunteers in much the same sense as those who are entering the Army.

Program for Joint Highway Convention Announced

Prominent Speakers Will Address State Highway Officials and Highway Industries Association

Announcement has been made of the programs of the joint convention and closed meetings of the American Association of State Highway Officials and the Highway Industries Association, to be held in Chicago from Monday, Dec. 2 to Friday, Dec. 6. Many speakers of national reputation will make addresses on highway construction, highway maintenance and kindred subjects.

Closed sessions of the highway officials' association will be held in the forenoon and afternoon of Monday, Tuesday and Friday at the La Salle Hotel. The Monday evening meeting of this organization will be open to the public, and on Tuesday evening the annual informal dinner will be held. Open joint meetings of the two associations will be held on Wednesday and Thursday at the Congress Hotel. Thursday evening will be given over to committee meetings, and on Friday the Highway Industries Association will hold an open meeting in the forenoon to discuss "Conditions We Are Facing," and an executive session in the afternoon.

At the open joint sessions on Wednesday the topic and speakers will be as follows: "Highway Control by Federal Government Under War Conditions," by Logan Waller Page, chairman of the United States Highway Council; "The Development of Motor Parcel Post Routes," by the Hon. James I. Blakeslee, fourth assistant postmaster general; "Highways—A Neglected War-Time Necessity," by the Hon. James M. Cox, Governor of Ohio; "A Suggested National Highway Policy and Plan," by E. J. Mehren, editor of *Engineering News-Record;* "Highway Transportation, Present and Future," by Roy D. Chapin, chairman of the National Highways Transport Committee, and "Highways a Military Necessity," general discussion. On Thursday two open joint sessions will be devoted to the following topics: "The Underlying Principles of Laying Out, Marking and Maintaining a State Trunk Highway System," by A. R. Hirst, state highway engineer of Wisconsin; "Proper License Fees for Motor Vehicles and Drivers," by H. Eltinge Breed, first deputy commissioner of highways, New York State; "Motor-Truck and Trailer Transportation Essentials—Regulation of Speed, Weight, Width and Height Necessary, But Should Not Restrict Their Expanding Use," by George M. Graham, chairman of the motor truck committee, National Automobile Chamber of Commerce and "American Highways for Tomorrow" by H. G. Shirley, secretary of the Highway Industries Association. The open meeting of the highway officials' association on Monday evening will have illustrated talks on "Notable American Highway Construction," by

P. St. J. Wilson, Office of Public Roads; "Recent Damage to Eastern Highway Systems," by W. G. Thompson, state highway engineer, New Jersey, and "Convict Labor in Road Work," by T J. Ehrhart, state highway commissioner, Colorado.

Four general subjects will be discussed at the closed sessions of the Association of State Highway Officials on Monday. They will be (1) "The Present Situation and How We Are Meeting It," summarized for their localities by Col. W. D. Sohier, chairman of the Massachusetts Highway Commission; John N. Mackall, chief engineer of the Maryland State Roads Commission; W. O. Hotchkiss, secretary of the Wisconsin Highway Commission; W. S. Keller, state highway engineer, Alabama; Ira R. Browning, state road engineer, Utah, and Charles T. Stern, California State Highway Commission; (2) "Ways of Doing Construction," various methods discussed by A. W. Dean, chief engineer of the Massachusetts State Highway Commission; Charles M. Upham, chief engineer of the Delaware State Highway Commission; F. F. Rogers, state highway commissioner of Michigan, and T. J. Ehrhart, state highway commissioner of Colorado; (3) "Materials of Construction," by Clinton Cowan, state highway commissioner of Ohio; Prevost Hubbard, United States Highway Council, and Clifford Older, chief highway engineer of Illinois; (4) "Engineers for Highway Work," by John H. Mullen, deputy commissioner of highways of Minnesota.

The subjects presented on Tuesday will be: "Coördinating State Highway Systems," by C. M. Babcock, state highway commissioner of Minnesota; "Snow Removal from County Highways," by G. H. Biles, acting chief engineer of the Pennsylvania Highway Commission; "Preparing for After We Have Won the War," by S. E. Bradt, state superintendent of highways of Illinois; "Regulation of Horse-Drawn Vehicles," by H. C. Beard, chairman of the Iowa State Highway Commission; "Eliminating Grade Crossings with Railroads," by W. S. Gearhardt, state highway engineer of Kansas; "Proper Engineering Treatment of Necessary Railroad Grade Crossings," by Rodman Wiley, commissioner of public roads of Kentucky, and "The Maintenance of Sand Roads," by George A. Duren, state highway engineer of Texas.

Civil and Mechanical Engineers Will Discuss Steel Conservation

Conservation of steel will be discussed at a joint meeting of the American Society of Civil Engineers and the American Society of Mechanical Engineers, to be held in New York on Nov. 20. The present urgent demand for iron and steel and feasible methods of conserving the available supply will be considered.

William A. Lydon, Harbor Contractor, Dies in Chicago

William A. Lydon, president of the Great Lakes Dredge & Dock Co., died at his home in Chicago Oct. 28. He was ill several months. As engineers and contractors, few men have left so indelible a record on the maritime development of the Great Lakes. Hardly a port from Buffalo to Duluth and Chicago is without an example of his work, either as designer or builder, for the

WILLIAM A. LYDON

services of William A. Lydon as an advisory engineer for works which his contracting firm did not build were as frequently in demand as he was as an actual builder. Much of his professional work was for the United States Government. Perhaps no man knew the construction conditions of all the Great Lakes waters better than did Mr. Lydon, and his death marks a distinct loss in the engineering and construction experience and ability available for the performance of maritime construction tasks involved in the industrial and commercial development of the Great Lakes ports and harbors.

Shortly after his graduation from Lehigh University in 1887, Mr. Lydon obtained employment in the engineering corps of the city of Chicago, with which he worked until 1890. He was a member of the surveying party which during this period conducted the original surveys for the main drainage channel of the Sanitary District of Chicago. Mr. Lydon's preference was, however, for the construction side of engineering, and he left straight professional work to organize the firm of Lydon & Drew, contractors. Besides doing general river and harbor work, this firm constructed the Lake View intake crib and the Hyde Park tunnel for the water-supply of the city of Chicago. In 1904 Mr. Lydon organized the Great Lakes Dredge & Dock Co. In 14 years this concern has acquired a place among the largest river and harbor works contractors of the United States, with a floating plant of great m[illegible]de and an enormous variety of eq[illegible]nt. Its works have included ship[illegible]s, dry docks, dredging, wharves [illegible] docks, bridge piers and subaqueou[illegible]ructures.

Mr. Lydon was born in Buffalo, N. Y., in 1863. He went to C[illegible]go as a boy, attended the public sch[illegible]s and entered Lehigh University, [illegible] which he received the degrees of civil engineer, engineer of mines and bachelor of metallurgy. He was a member of the American Society of Civil Engineers, of the Western Society of Civil Engineers and of the Illinois Structural Engineers' Association. He is survived by Mrs. Lydon, two daughters and a son.

New Emergency Power Bill

Some months ago a bill was introduced into the House of Representatives, and later passed by that body, authorizing the appropriation of $200,000,000 for emergency power purposes. The bill is now before the Senate Commerce Committee for further consideration, and seems to be permanently blocked. On account of the urgent necessity for more power, however, another emergency power act was introduced in the Senate Oct. 28 by Senator Fletcher of the Committee on Commerce. This is a joint resolution authorizing the War Industries Board to aid in equipping and expanding power plants to carry on the manufacture of war munitions and the construction of ships during the war, and to advance money for that purpose to owners and operators of private plants, on terms and conditions to be prescribed by the War Finance Corporation. For this $50,000,000 is to be appropriated.

No City Contracts for Aliens

The city commission of Trenton, N. J., has decided not to award contracts to contractors and builders who are not citizens of the United States, this action being decided upon after complaint that citizens were unable to obtain contracts on city buildings when awards were made to noncitizens.

ENGINEERING SOCIETIES

The Engineers' Club of Philadelphia will be addressed at the regular meeting Nov. 19 by George W. Braden, former Y. M. C. A. director of athletics and recreation for the Italian Army. Mr. Braden will speak on "Overseas Experiences in Italy," his talk being illustrated with lantern slides. Italy's place in the war, her man-power and industrial mobilization, the needs of recreation in her army, and the results of the introduction of American recreational sports in raising the morale of the army will be outlined.

During the summer the club instituted a series of Tuesday noon luncheons. Maj. Gen. L. W. T. Waller, U. S.

Calendar

Annual Meetings

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS; A. Dennis Williams, Morgantown, W. Va., acting secretary; Dec. 2-6, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS; 29 West 39th St., New York City; Dec. 3-6, New York.

AMERICAN PUBLIC HEALTH ASSOCIATION; 126 Massachusetts Ave., Boston; Dec. 9, Chicago.

M. C., spoke on "The United States Marine Corps" at the luncheon Nov. 5. Philip Francis Nowlan, of the Philadelphia *Public Ledger* staff will speak on "Sales Engineering" at the luncheon to be held Nov. 12.

The Albany Society of Civil Engineers was addressed at the meeting Oct. 29 by Maj. E. Harold Cluett, Troy, N. Y., who spoke on "Personal Experiences in France."

Personal Notes

COL. JAMES G. STEESE, Corps of Engineers, assistant to the Chief of Engineers, has been detailed to the General Staff and appointed executive officer of the Personnel Branch, recently organized to handle personnel matters for all branches of the service.

N. L. ARBUCKLE, assistant engineer maintenance of way, the Cleveland, Cincinnati, Chicago & St. Louis Ry. at Indianapolis, Indianapolis Terminal division, has been appointed acting engineer maintenance of way at the same point, succeeding I. M. Brown, deceased.

WILL M. LEE, of the Morrison Construction Co., Des Moines, Iowa, and formerly county engineer of Winnishiek County, Iowa, has been appointed district engineer for the sixth district of the state, succeeding H. L. Phelps, now in military service. Mr. Lee's headquarters will be at Cedar Rapids.

W. N. HALL, drainage engineer, Bureau of Public Roads, Washington, D. C., has been transferred to Clemson, S. C., for the purpose of making investigations of drainage, under a coöperative agreement between the drainage investigations bureau of the Office of Public Roads, and the State College of Agriculture of South Carolina.

ROBERT E. KLINE, Dayton, Ohio, who a year ago gave up his duties as vice-president of the Barkelew Metal Products Co., of that city, to become supervising engineer for the Emergency Fleet Corporation, has been appointed United States district engineer for the Emergency Fleet Corporation with jurisdiction over New England shipyards.

S. A. JORDAN, assistant superintendent of the Baltimore & Ohio R.R. at Brunswick, Md., has been appointed engineer maintenance of way, with office at Baltimore. He succeeds J. B. Myers, assigned to other duties.

JULES R. BREUCHAUD, secretary of the Underpinning & Foundation Co., New York City, has been commissioned in the Construction Division with the rank of captain, and temporarily assigned to duty in Washington, D. C.

T. J. WASSER, county engineer of Hudson County, New Jersey, has been appointed to the executive section, Highways Transport Committee, and assigned to the work of keeping the New Jersey section of the Buffalo-Baltimore Army route clear during the coming winter.

MAJ. DALE BUMSTEAD, Ordnance Department, formerly manager of the Chicago office of the E. I. DuPont de Nemours Co., has been promoted to the rank of lieutenant-colonel.

L. B. ELLIOTT, acting engineer maintenance of way of the Cleveland, Cincinnati, Chicago & St. Louis Ry. at Indianapolis, Peoria & Eastern division, and R. B. Stokley, acting engineer maintenance of way at Springfield, Ohio, have exchanged places.

V. BERNARD SIEMS, formerly assistant engineer, Baltimore City Water Department, and recently water engineer at Camp Meade, Maryland, has been appointed principal assistant engineer of the Baltimore City Water Department.

CHARLES SAVILLE, director of sanitation, Department of Public Health, Dallas, Tex., has been made director of the recently organized department of industrial development of the Chamber of Commerce and Manufacturers' Association.

J. L. KIRBY, division engineer of the Seaboard Air Line Ry. at Atlanta, Ga., has been appointed engineer maintenance of way, with office at Norfolk, Va., succeeding J. C. Nelson, deceased.

JOHN G. LAVERY, city engineer of Summit, N. J., has resigned to enter the service of the United States Housing Corporation, with headquarters at Pittsburgh.

W. B. RIGBY, Maquoketa, Iowa, has been appointed county engineer of Jackson County, succeeding Charles M. Fisher, resigned.

Obituary

LIEUT. PAUL H. CORDES, 30th Engineers, was killed in action Sept. 12 on the western front. Lieutenant Cordes was 31 years old. For the past five years he was sales engineer in the Chicago office of the Worthington Pump & Machinery Corporation.

LIEUT. EDGAR M. WHITLOCK, 102nd Engineers, is reported killed in action. He was 27 years old and a graduate of Cornell University.

CLARENCE COLEMAN, United States engineer, Duluth district, died in Duluth, Oct. 24, in his 70th year. Mr. Coleman entered engineering work in 1873 as a rodman for the Houston & Texas R.R., remaining in railroad work, in the service of various companies, until 1890, when he resigned as chief engineer of the Santa Fé Southern Ry. to enter private practice at Roanoke, Va. Later he became city inspector of buildings of Roanoke. In 1894 he was appointed United States assistant engineer on breakwater work at Marquette, Mich., and three years later he became secretary of the board of civil service examiners, at large, for the United States Engineer Department. Mr. Coleman had lived at the head of the great lakes for the past 24 years and had been in charge of construction and improvement work in the Duluth-Superior harbor.

CLYDE D. GILBERT, associate editor of *Concrete* since April, 1915, died of pneumonia in Allentown, Penn., Oct. 18, while on a trip of inspection in the Lehigh Valley cement-manufacturing region. Mr. Gilbert attended the University of Vermont for two years, and was afterwards employed by the Van Guilder Double Wall Co. of Rochester, N. Y., previous to his association with the editorial staff of *Concrete*.

CHARLES RIDGELY HANSCOM, who was in charge of the building of the steamships "Minnesota" and "Dakota" at Groton, Conn., in 1913-14, died Oct. 31 in New London, Conn., in his 69th year. Mr. Hanscom was born in Portsmouth, N. H. He was associated with the Navy Department in Washington in 1880-1890, and the following six years was general superintendent of the Bath Iron Works, Bath, Maine.

HOWARD J. KLINZING, contracting engineer, Pittsburgh-Des Moines Steel Co., died at his home in Pittsburgh Oct. 23, at the age of 31.

NEWS OF ENGINEERING INDUSTRIES

FOR MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Manufacturers' Export Association Stands for Broad Coöperation in Foreign Trade

Assistance to Reconstruction Pledged and Creation of Merchant Marine Urged at Ninth Annual Convention

The building up of foreign trade on a plane of broad-gage assistance to the allies, who have suffered more through the war than has the United States, to give assistance for the rebuilding of Belgium and France, the restoration of a large American merchant marine, were the paramount themes of the ninth annual convention of the American Manufacturers' Export Association held last week in New York City. The convention was the largest ever held by the association, more than a thousand manufacturers and their representatives attending, and it is reported that the banquet was the largest ever held in New York.

Resolutions were passed at the executive session, on the opening day, pledging the association to render every possible assistance in the rehabilitation of France and Belgium at the earliest possible moment after victory shall have been attained.

Changes in the constitution of the association were effected, and the convention elected its former president, George Edward Smith, of the Royal Typewriter Co., to head the association for the ensuing year. A new board of direction was also chosen.

Assistance to Export Trade

The association went on record as unqualifiedly in favor of adopting means whereby the financial assistance necessary for the furtherance of American export trade shall be expedited. Resolutions to that effect, passed by the finance committee and adopted at the executive session, are as follows:

"Resolved, that in connection with financing exports from the United States, this association believes it imperative that prompt attention and action be given to: (1) Coöperation with such agencies as will quickly make available proper and adequate credit information on foreign buyers; (2) development of the use of the dollar acceptances of American banking institutions, giving, for the purchases of American goods, the authorization of foreign buyers for their local banks; (3) broadening the American market for American dollar, bank and trade acceptances, through encouragement of the Federal Reserve Board, and through propaganda; (4) assisting in every way possible the study of foreign languages and financial customs on the part of a sufficient number of members of each American banking and export organization; and (5) it is the opinion of this association that the present facilities of American banking institutions are able to finance our present and future foreign trade, and that full development of these facilities can be accomplished only by a complete understanding on the part of the financial management of exporting houses of the very complete advantages now provided by law for their benefit."

Trade Education Advocated

In discussing the educational facilities which are at present afforded to the young men of the nation to prepare themselves for the field of international commerce, it was the opinion of the convention that the inauguration of a system of education in the training camps afforded the best means of furnishing the trade with expert operators immediately on the conclusion of peace. The association adopted the following resolution:

"Resolved, that the Secretary of War be respectfully and earnestly requested to utilize at the earliest possible moment the officers of his Commission on War Camp Activities, the Y. M. C. A. and other available agencies connected with our military operation at home and abroad, in assisting the imperative national need for education for foreign trade service."

The above resolution was adopted after the reading of a paper prepared by the president, George Edward Smith, who advocated the converting of the American Expeditionary Forces into the pioneer legions which are to uphold American future in all trades after the war. In this connection Professor John Erskine, of Columbia University, and chairman of the American educational commission, who was in this country on

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Only One Copy of Export Application Forms Required

The War Trade Board, in a recent bulletin, explains that, in submitting applications for export licenses, only one copy of form X, also of any supplemental form, is required. The only documents of which more than one copy is required are the lists of commodities which in some cases are attached to form X in answer to question five. These lists must be furnished in triplicate.

New Priority Regulations Governing Production

New rules and regulations governing priority and production have been issued in supplement No. 2 to circular No. 4 issued July 1, by the War Industries Board, Priorities Division. Class C, which was mentioned in recent bulletins regarding export licenses, is more amply defined.

It states that Class C comprises all orders and work other than those covered by priorities certificate issued by the Priorities Committee, and automatic rating in accordance with provisions of sections 7, 7A, 7B, 8 and 8A, which orders and work are placed by and are to be utilized in connection with an industry or plant appearing on preference list No. 2. It states that these rulings cover orders and work which are to be utilized in furtherance of one or more of the following purposes or uses:

1. Maintenance of existing equipment for the supply of heat, light, power and sanitation. 2. For necessary supplies and essential repairs (not extensions or replacements) to existing buildings and manufacturing plants. 3. Operation of machine shops and blacksmith shops. 4. For wire cloth for screening buildings. 5. Nails, screws, rivets, bolts, nuts and washers used for any purpose. 6. For all necessary repairs to equipment, vehicles, implements, machinery of every nature whatsoever. The bulletin also gives automatic ratings for War, Navy and other departments of the Government which may apply, and for certain repairs. The instructions include interpretation of term "materials and equipment," alternative procedure for obtaining automatic ratings, limitation on use of automatic ratings, priorities for jobbers, industry priority certificates, priority on export orders, rule regarding delivery dates, and instructions for obtaining the ratings.

Industrial War Service Convention Planned for December

The Chamber of Commerce of the United States has just announced plans for a convention to be held at Atlantic City, Dec. 4-6, representing the Industrial War Service Committees, more than 300 in number, now operating in the United States. The convention is called mainly to establish reconstruction programs. According to the announcement given out, the main purposes of the conferences will be the determination of practical methods whereby industry may coöperate still more closely with the Government, through a centralized scheme of organization.

Annual Meeting of National Industrial Traffic League

The National Industrial Traffic League will hold its annual meeting at the Hotel Sinton, Cincinnati, Ohio, Thursday and Friday, Nov. 21-22. The notice states that the docket for the meeting will be distributed about Nov. 10, giving in detail the subjects to be considered. Many of these subjects, it is said, will be of considerable importance, and every member is urged to arrange his appointments so as to be able to attend this meeting, and it is desired to invite to the meeting traffic representatives of organizations or individual concerns not members of the league.

It is requested that lists of names of such representatives be sent to E. F. Lacey, assistant secretary of the league, 413 Tacoma Bldg., Chicago, Ill., who will supply them with copy of the docket and invitations to attend. It is suggested that the official invitation extended to them by the secretary be supplemented by personal invitations.

Procedure Governing the Export of Steel to Italy

The War Trade Board announces that licenses for the exportation of steel to Italy will be granted only upon the receipt of evidence that the steel will be transported at a rate of freight not exceeding that of $67.50 per ton of 2240 lb., or 40 cu.ft., ship's option, on pieces and packages not over 4480 lb., as established by the United States Shipping Board. The rate applies to the following: Structural iron and steel, iron and steel shapes, plates, nails, bolts, nuts, sheets, plain and corrugated, plain and barbed wire, billets, bars, rails and fastenings, pig iron, and pipe.

It is stated that this ruling does not apply to applications for licenses to ship steel purchased by the British, French or Italian Government.

Factory Adopts Measures To Fight Influenza

In an effort to combat the spread of the Spanish influenza the S. F. Bowser Co., oil tank and pump works, Fort Wayne, Ind., has established stations about its plant for the free treatment of its employees. Every employee is requested and expected to have his or her nose and throat sprayed at least twice daily. Specially instructed attendants for the spraying are on hand. Bulletins have been prepared and posted regarding the disease, the care of the nose and throat, and necessary precautions against dust and other dangers. As a further measure, certain employees have been sworn in as deputy health commissioners, with full power to enforce all rules and laws of the Health Department. It is their duty to take action — drastic if necessary — to prevent the spread of the disease through spitting, coughing and sneezing, and to report all cases of sickness.

Renewed Diversion of Labor From Less Essential Work To Be Made by War Industries Board

Drastic Measures To Be Effected Told by H. B. Swope, of the War Board, at Manufacturers' Export Convention

That within a month, a gigantic diversion of labor and materials from the less essential pursuits to war work will be carried out by the Government was the statement of Herbert Bayard Swope, member of the War Industries Board, at the banquet of the American Manufacturers' Export Association in New York Oct. 31. Mr. Swope, who is the assistant to Mr. Baruch, chairman of the board, said that the point has been reached in our war production for the allocation of labor according to need, rather than desire. He announced that plans have been completed for active coöperation between the War Industries Board and the provost marshal general so that a wholesale diversion of labor may be effected before it becomes necessary to tap the industries themselves. It is planned to take over into work that will contribute to the war program more than 300,000 able-bodied male citizens who are now engaged in non-war work. Plans have been completed for a corresponding substitution of women for the men thus taken from their present employment. He named a few of the lines of employment which are to be affected, including those of waiters, chauffeurs, servants, elevator attendants, and certain classes of retail salesmen.

Less Essential Plants Affected

Mr. Swope said that likewise certain of the less essential industries will be stripped of their male employees as far as the substitution of women will permit. As an illustration, he mentioned the making of metal bedsteads, saying that women would have to be relied upon to do practically all the work in such industries.

He said that through the withholding of raw materials a still further pressure would be brought to bear upon manufacturers of less essential articles, in the Government's determination to let nothing stand in the way of maximum war production.

Continuing, Mr. Swope said:

"Wars are fought and won or lost on the land, on the water, in the air and in the workshops. It is not enough to mobilize the nation's military strength; there must be a mobilization of her full financial, economic and industrial resources. These must be organized, coördinated and commanded with the same strategy that governs the operations of the purely military arms of service.

"The prodigious strain upon the world's productive capacity must be met and balanced to provide the means of warfare and to maintain the civilian population, as well as to preserve the economic fabric.

"The responsibility for the control and regulation of industry in all its direct and indirect relations to the war and to the nation has been placed by the President in the hands of the chairman of the War Industries Board. This board is charged with the duty of procuring an adequate flow of materials for the War and Navy Departments, the Emergency Fleet Corporation and the Railroad Administration. Also, the board provides supplies necessary to the military needs of our associates in the war, and those commodities required by neutrals in exchange for materials essential to us.

"Finally, and of paramount importance, the board, in alliance with the food, fuel and labor administrations, provides for the country's civilian needs, the protection of which is a particular duty of the organization.

"It stimulates the production of those materials essential to the war program and, at the same time, depresses and curtails the production of those not of a necessitous nature. This is done by regulation of the basic economic elements (a) Facilities; (b) materials;

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Project Involving 1,000,000,000 Feet of Lumber Launched

Plans for the cutting of 1,000,000,000 ft. b.m. of lumber have been made by New York interests, backed by the United States Government. Offices have been established in Charlotte, N. C., and the project will include the cutting of 5,000,000 to 6,000,000 railway ties. It is expected that the work will require 50 sawmills. The area to be cut over amounts to about 250 square miles in North Carolina, South Carolina and northern Georgia.

Motor trucks will be used to convey the timber to railway points, and it is expected that approximately $750,000 will be expended in building roads, mainly concrete highways. The company expects to produce about 50 carloads of timber materials per day, and says that the United States Government will take all that will be produced for at least a year to come.

Japanese Commercial Museum in Singapore

There is about to be established in Singapore a commercial museum under the direction of the Japanese Department of Agriculture and Commerce. The object will be the promotion and extension of Japan's trade during and after the war. The necessary arrangements in this connection have been intrusted to the South Sea Society, the

funds for the establishment and maintenance of the museum to be supplied by the Japanese Government.

With regard to this enterprise the Japanese Minister of Agriculture and Commerce stated that the proposed commercial museum at Singapore is designed to serve as a central base of Japan's commercial operations in the Pacific Ocean islands. The functions of the museum will be divided into a number of sections. Merchandise will be exhibited and investigations made relating to trade and commerce. It will also serve as a medium for Japanese exporters and foreign importers to form more intimate relations.

It is understood that similar institutions are contemplated for other places, including one at Harbin.

Manufacturers' Export Convention

(Concluded from page 872)

a short visit from the western front and who is returning with a large staff of trained educators and an equipment of American text books and educational material, told of the great work now in progress and plans for the education of our student soldiers. Mr. Erskine stated that orders have been issued by General Pershing providing that, as soon as fighting has ceased, the boys in the American Army shall have six hours a day instruction under Army auspices. This is to be followed by a finishing course of three months' intensive training in the leading technical and commercial schools of France and Great Britain, where arrangements have been completed for placing our own teachers alongside the faculties of these institutions. The commission has already begun its work by offering educational facilities to the soldiers during their rest periods, and these offers have been eagerly accepted by a large number of the boys. More than 200,000 enrollments have been recorded in the French classes, and classes are now being conducted in Spanish, Portuguese, commercial geography, natural resources and manufactures of the different countries. Mr. Erskine told of the great eagerness with which a very large number of the soldiers are taking to the educational facilities offered, and predicted that after the conclusion of the war and the return of our men to peaceful pursuits a great army of young Americans would be ready to lead us in commercial life and world-wide industrial development.

To Investigate Training for Foreign Trade

In view of the interest in education for foreign trade that is developing in many directions, and the immediate need of centralized effort in its behalf, the association passed resolutions advocating the establishment, under Federal control, of adequate forces of instruction in preparation for foreign trade, and that the committee of fifteen appointed by the United States Commissioner of Education be supplied by Congress with powers and funds to investigate and report on training for foreign trade and a national policy in regard to it.

A paper on "A Genuine Department of Commerce," was read by B. S. Cutler, chief of the Bureau of Foreign and Domestic Commerce. In it, after explaining the financial limitations of his bureau, he advocated adding a division of industrial practice to aid in the elimination of waste, a division of material valuation for studying the original sources, the handling and the grades of foreign and domestic materials, a division of information in interior waterand railways, a division of distribution economy and a division of cost-finding methods. After hearing this paper the association passed resolutions asking Congress for increased appropriation to carry on this important work.

Mayor Preston of Baltimore addressed the convention in behalf of the Southern Commercial Congress, and urged the attendance of the members in Baltimore next December. This was followed by a practical demonstration of the filling of a foreign order, from the receipt of the order in the language of that country to the actual delivery of the goods. The demonstration was made by Frank Waterman of the staff of the L. E. Waterman Co., and was illustrated by actual orders, goods, packing cases, etc. Mr. Waterman pointed out the difficulties that have arisen from the payment of insufficient postage on foreign mail, and showed how his company is successfully avoiding mistakes in this matter through the use of different colored envelopes, providing not only colored envelopes for all foreign mail, but having various colors to denote the amount of postage required.

United States Army Packing Service Explained

Capt. H. R. Moody, representing the packing service of the United States Army, gave a talk on what is being accomplished in the way of conserving space in transport through the scientific packing of goods for export. He told how, as a result of the study of a shipment of motor trucks and the working out of a standard form of packing, five trucks are now shipped in the steamer space formerly required by one. He outlined the object of the Government packing service, and stated that assistance would gladly be given to any American shipper in working out a standard form of case or package for oversea shipment if they would address "'Packing Service, United States Army, Washington, D. C." It is the purpose of the Government to give all American shippers the benefit of its scientific studies in connection with Army shipments. He explained that in Army shipments specifications for packing are now made part of the orders, and that failure to comply with these specifications entails a penalty.

"Our Ships After the War" was discussed under several heads as "Our Mercantile Marine" [illegible] Mackey, vice-president of the Barber Steamship Line, and Joseph [illegible]son, traffic manager of the New York and Cuba Mail Steamship Co. (Ward Line) outlined, from their experience in the handling of merchant ships, the possible handling of our merchant marine after the war. Joseph J. Schlechta, traffic manager of Gaston, Williams & Wigmore, under "How Shall We Have a Real Merchant Marine?" treated the subject from an economic point of view, and pointed out the necessity for a reciprocal policy if the United States is to retain the friendships formed abroad by the war and which will be necessary in the prevention of a "war after the war." John Meigs, of the Harriman Steamship Line, in discussing the urgent need of port and terminal improvements, pointed out that these facilities should be a function of the Federal Government.

Application of Webb-Pomerene Law

Gilbert H. Montague, of the New York bar, and counsel to the special committee of the association in support of the Webb-Pomerene law, gave a brief of his paper on "How Different Types of Selling Organizations May Obtain the Benefits of the Webb-Pomerene Law." He explained the several methods whereby competing companies may unite under the law for the purpose of foreign selling, and cleared up many points on which the law was misunderstood. He illustrated some of the many ways by which the branch house, the export house, the house selling through local dealers, the house selling through travelers, as well as the joint selling organization, all may obtain the benefits of the Webb-Pomerene law. He concluded by saying: "If the Webb-Pomerene law is sympathetically utilized by the business community, and is sympathetically applied by the Federal Trade Commission, and as occasion arises is intelligently broadened by further legislation, it will certainly prove one of the most effective agents in the upbuilding of American export trade."

The sessions of the convention closed with a paper by the Hon. John Walsh, chief counsel for the Federal Trade Commission, on "The Webb-Pomerene Law as it is Being Administered."

He said that, although a number of industries filed the necessary papers under the law there was none actually engaged in foreign trade under its provisions. He indicated the manner in which the Federal Trade Commission could aid in the work.

At the banquet, which was the final event of the convention, Herbert Bayard Swope, of the War Industries Board, conveyed a message from Mr. Baruch, chairman of the board, and told of the drastic steps soon to be taken by the War Industries Board in diverting all available labor from those industries deemed less essential to actual work. Mr. Swope's message is given in another article in this issue.

Diversion of Labor

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(c) fuel; (d) transportation; (e) labor and (f) capital. The method of control is through a preference list on which are placed those industries whose output is essential to the war's progress, and the priority indicated by the preference list is the master key to the six elements named.

"Furthermore, the board regulates all and controls certain other industries of first-rate war importance; it fixes prices; it creates new and converts old facilities; it clears the national business requirements, and it leads in conservation, which is needed to bridge the gap between the extraordinary demand and the available supply—a gap which exists in almost all the great commercial staples.

"The abnormal conditions of the war demand sacrifices. It is the price of victory. Only actual needs, not fancied wants, should and can be satisfied. To save heavy and long privation, temporary deprivation must be the rule. America's willingness to accept these conditions marks her ability to quicken the end of the conflict."

In concluding his address, Mr. Swope read a message from Mr. Baruch, chairman of the War Industries Board, in which he commended the spirit of American business in making itself an effective and willing force in the nation's life.

Increased Municipal Efficiency in Convertible Motor Trucks

Increased efficiency in municipal street work is obtained through the use of motor trucks, the chassis of which can be converted from summer to winter use. The New York street-cleaning department has a number of Mack trucks fitted with tanks, with flusher and sprinkler attachments for the summer street-cleaning service. When freezing weather prohibits the sprinkling of streets these chassis are converted into automatic dump trucks, with steel, inclosed, sanitary garbage and earth collection bodies.

CITY TRUCKS IN USE ALL YEAR

It is pointed out that a saving is effected by obviating the necessity for laying up flushers and sprinklers during the winter, representing, as it does, a loss on the truck investment, since by the use of these interchangeable chassis the trucks are made an all-year truck investment. These machines are manufactured by the International Motor Co., New York.

OBITUARY

FRANCIS R. CRISPEN, secretary and director of the Traylor Engineering and Manufacturing Co., and of the Traylor Shipbuilding Corporation, died of pneumonia, following an attack of influenza. He was born in Lock Haven, Penn., in 1882, was graduated from Girard College in 1898 and was admitted to the Philadelphia bar in 1906. In 1908 he took a position as private secretary and counsel to Samuel W. Traylor, from which position he advanced to the position of secretary and director of the Cement Gun Co., Inc., and secretary, treasurer and director of the Dewey Cement Gun Co., acting as counsel for all these companies at the same time.

L. R. GULLEY, general manager of the Burr Co., foundry and machine shops, Champaign, Ill., died Oct. 22. Mr. Gulley was 32 years of age and had been associated with the Burr Co. since his graduation from the University of Illinois in 1910. He took the civil engineering and mechanical engineering courses in four years.

WILLIAM M. HUSBANDS, vice-president and one of the organizers of the Standard Metal Co., Indianapolis, died a few days ago at his home in Indianapolis. He distinguished himself in the selling end of the metal trade, and for 42 years traveled over the same route, calling upon the shops and foundries in his territory. He was one of the oldest members of the United Commercial Travelers of Indianapolis.

BUSINESS NOTES

The Lakewood Engineering Co., Cleveland, O., announces the opening of its own offices in New York City at 111 Broadway, with George S. Hedge, district manager, in charge.

The W. J. Crouch Co., Inc., and Rownson, Drew & Clydesdale, Inc., announce the amalgamation of their respective organizations under the name of Rownson, Drew & Clydesdale, Inc., with general offices at 68 William St., New York, N. Y. P. G. Donald is president; I. Smullyan, managing director; John J. Smart, in charge of engineering division; John H. Allen, assisted by M. Greenberg, purchasing agent.

The Patterson-Kelley Co., manufacturers of feed-water heaters and hot-water heaters, announces the removal of its Philadelphia office to the Harrison Bldg., 15th and Market Sts. It is in charge of F. E. Glenn.

The T. A. Scott Co., Inc., marine wreckers and contractors, announces the removal of its offices from 400 Border St. to 113 State St., corner of Broad St., Boston, Mass.

J. A. Currey, Portland, Ore., local manager of the Truscon Steel Co., has been named Federal Commissioner of Building Permits.

The Universal Construction Co., Ltd., Victoria, B. C., has been incorporated for $250,000, to enter general contracting business.

TRADE PUBLICATIONS

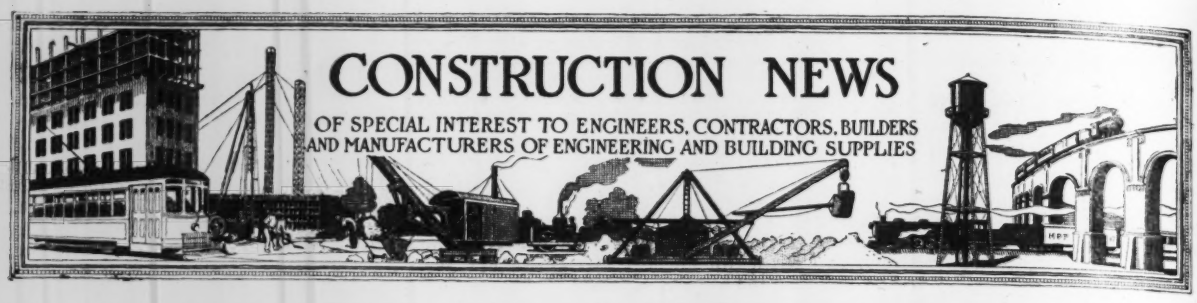
"Jeffrey Belt Conveyors" is the title of an 80-p. catalogue issued by the Jeffrey Manufacturing Co., manufacturers of coal-mining machinery, electric locomotives, etc. It is illustrated with half tones and line cuts and contains tables and other engineering data collected from belt-conveyor practice. The information covers the field from early types of belt conveyors to the latest output of the Jeffrey Manufacturing Company.

The Armstrong Cork & Insulation Co., Pittsburgh, has published a 37-p. catalogue entitled "Linotile Floors."

"Lock Joint Reinforced-Concrete Pipe" is the title of a 64-p. 8 x 11-in. catalogue issued by the Lock Joint Pipe Co., 165 Broadway, New York.

Giant trucks, manufactured by the Chicago Pneumatic Tool Co., Chicago and New York, are illustrated and described in a 34-p. 9 x 12-in. catalogue, numbered 344.

The Thew Automatic Shovel Co., Lorain, Ohio, has issued Industry Bulletin No. 29, illustrating and describing the Thew shovel for underground work. It contains cost and power data as well as cuts showing the shovel working under various conditions. The New York office of the company is at 30 Church Street.


CONSTRUCTION NEWS
OF SPECIAL INTEREST TO ENGINEERS, CONTRACTORS, BUILDERS
AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES

Prices Will Be But Slightly Affected by Early End of Hostilities, It Is Believed

Except Ammunition, Many Supplies Are Needed for Lengthy Period Before and During Return of Troops

The effect of an early cessation of hostilities on the general financial situation and prices is the subject of wide inquiry and study. It is believed, however, that, owing to the long period that must necessarily intervene between the actual end of fighting and demobilization, a large amount of war supplies, except shells and explosives, will be required for the maintenance of the Army overseas. It is probable that the armies will be maintained in the field until the allied governments have sufficient assurance to guarantee a permanent settlement, and, although comparatively small in comparison to the total numbers now under arms, a certain number of troops will be held in Europe to assist in reconstruction. Reconstruction activities which will commence at once will also require increasing amounts of materials.

Further Bond Issues Probable

On the other hand, the tremendous load on the financial structure of the country due to war expenditures (amounting to more than $20,000,000,000 to date) points to heavier taxation and more bond issues. It is estimated that more than $3,000,000,000 of of the Fourth Liberty Loan has already been spent, and at the present rate of expenditure the remainder will last less than six months. The effect will be felt in every branch of business, and especially in the banking situation, with especial reference to money rates. It is estimated that since the United States entered the war the Federal reserve banks have issued more than $2,000,000,000 in notes, in addition to expansions caused by their loan operations, and that there is less than $1,500,000,000 for further expansion. At the present rate, this limit of expansion will be reached in less than a year. Though it is not believed that the United States will allow the banks to reach this condition, it would bring the financial situation into so tight a shape as to make a financial shock dangerous. Every curtailment of credit for non-essential purposes would therefore be necessary; this, in turn, would have its effect on the money supply—and money supply, it is well understood, has a direct effect on prices. This country is already the heaviest creditor in the world, and the lowness of the stocks of money in the European countries will have its effect on foreign trade. In other words, until the different nations arrive at the point where they can pay off the debt in commodities rather than money, the extension of further credit to pay for reconstruction material, etc., will be difficult.

Financial Situation Complex

The bankers of the country mention these factors to show the complexity of the situation and point to an element of danger that exists, in ever-increasing quantity, toward expansion among the industries supplying direct and indirect war materials.

Although a curtailment of the money supply will bring about lower prices, the adjustment that will be necessary in the business world will be of such disturbing character, bankers point out, as to offset any advantage that will accrue from lower prices.

The steel shortage is such as to indicate that it will extend well into 1919, although a certain measure of relief has been obtained for the present by reallotting steel from the railroads and shipyards to those plants feeling the shortage most acutely.

Plates have been furnished for shipbuilding faster than the rate of consumption, and the Railroad Administration has curtailed its demands for the purpose of the allotment. These measures, together with the large margin of safety which was allowed in making up the estimates, will tend toward meeting the demand.

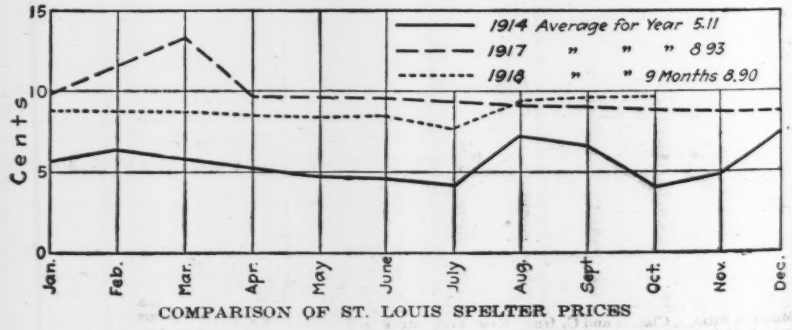
A shortage of brass has developed in the past two months, according to figures compiled by Everett Morse, chief of the nonferrous tubing section of the War Industries Board. The shortage in the copper and tin supply is largely responsible for this situation, since there is no shortage in zinc. Also, many articles heretofore made of brass can be supplied in zinc.

The Price-fixing Committee has announced an agreement made between the producers of copper and the committee fixing the same maximum price of copper (26c. per pound) for the period from Nov. 1 to Jan. 1, 1919, as that of the previous period. The agreement stipulates measures necessary, under the direction of the War Industries Board, to prevent the supply from falling into the hands of speculators, who might increase the price to the public, should the supply be such as to create such a contingency; and requires a pledge to exert effort necessary to keep up the production of copper, so as to insure an adequate supply as long as the war lasts. At present, practically all of the refined copper produced is absorbed either directly or indirectly by the Government, and the business done outside is negligible.

Zinc Prices Compared

A comparison of zinc prices for the past two years with those prior to the beginning of the war shows that the price in 1918 will fall below that of 1914 if the comparison is made according to the ratio of the money in circulation in the two periods.

Production of lumber will be restricted to the filling of essential requirements, under regulations issued by the War Industries Board. The control of the output will be exercised by the board through the allotment of priority of labor, material and equipment. Essential purposes for which deliveries of lumber may be made include Government or allied requirements, and needs of the public in which lumber is essential to war work.



COMPARISON OF ST. LOUIS SPELTER PRICES